THE MODEL ENGINEER

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The MODEL ENGINEER

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SMOKE RINGS

Our Cover Picture

● THE SUBJECT this week calls for special consideration because it is a working model. We all admire the wonderful exhibition models of sailing ships one sees from time to time, but when we have a model such as this, which is well up to exhibition standards, and at the same time actually sails in the same manner as its prototype, we have something which is superior to both the exhibition model and the sailing yacht. The depth of keel has had to be increased to give sufficient stability but above water she is correct to scale and represents her type very faithfully. The rigging is arranged as in the actual ship, and, as there are square sails only on the foremast, the work of trimming the sails for going about is not unduly complicated. We have seen this model in action, and can assure our readers that she sails well, keeps her course, and has a very satisfactory turn of speed. In fact, when reaching on a beam wind, a model of this type can give the Bermuda-rigged racing sloop a very keen race. The building and sailing of square-rigged ship models is rapidly gaining in popularity, and all over the country ship modellers are taking up this most fascinating phase of the hobby. There are a number of very fine examples in London, and on any Sunday morning some of them may be seen showing their paces at the Round Pond, Kensington. The model was built and is sailed by Peter M. Wood, the well-known marine artist.

An Easter Attraction for Fleetwood

● FLEETWOOD IS to be the scene, at Easter, of a real novelty in the form of an international radio-controlled model boats contest on the large Model Yacht Lake in that popular Lancashire resort. The event will be spread over two days, Easter Sunday, April 9th, and Bank Holiday, April 10th.

For the first time in the history of model boat sailing in England, all the competitors will control their boats by radio, and this should attract a large attendance on both days.

The contest is being sponsored by the *Daily Dispatch* and organised by the Radio Controlled Models Society. The entries will include: (1) Working model ships and displacement power boats, and (2) Working model yachts and sailing ships. Valuable prizes will be given by the sponsors and the Fleetwood Corporation.

An Interesting Centenary

● MARCH, 1950, has marked the centenary of one of the world's most outstanding railway engineering structures, the famous Britannia tubular bridge over the Menai Straits. A special Act of Parliament granting powers for the construction of this noble bridge was passed on June 30th, 1845, and on April 10th, 1846, the foundation stone was laid by Mr. Frank Forster, the resident engineer at that time. The construction was planned on similar lines to the contemporary bridge then in course of erection at Conway, but on a very much larger scale.

Robert Stephenson was responsible for the actual building of the bridge, and he devised an ingenious scheme which proved highly successful; proof of this is the fact that the bridge stands today, perfectly sound and carrying a weight of traffic that could hardly have been foreseen a hundred years ago. There are two abutments and three towers; these, in order, are known as: the Caernarvonshire Abutment, the Caernarvonshire Tower, the Britannia Tower, the Anglesey Tower and the Anglesey Abutment, and they are connected by tubes built of malleable iron which are laid in pairs and riveted together to form the four spans.

The task of erecting this bridge was a very difficult one due largely to the lack of any modern facilities for such work. The shorter tubes linking the shore abutments to the outer towers were comparatively easy to erect, since they are over land and could be constructed in position; but the spans linking the outer towers to the Britannia Tower presented a very different problem. This was solved by erecting the huge tubes on the shore and then floating them into position on pontoons, the spans formed by the tubes being left between the towers on ledges provided for the purpose, roughly at high-water level. Then the task of raising the tubes began; using hydraulic presses, the spans were jacked a few feet and the masonry built up under them, this process being repeated again and again until they were in their proper position 100 ft. above high-water mark. Each tube span was then riveted to the preceding one to make a continuous length of tubular bridge.

After passing severe tests, one of the tubes was brought into use for regular traffic on March 18th, 1850. The complete bridge was officially opened and brought into full public service on October 21st, 1950, and is a lasting monument to clever design and outstanding engineering achievement.

Progress at Nuneaton

● MR. E. G. ANSLOW, hon. secretary of the Nuneaton and District Society of Model Engineers, has sent us a long report of the society's activities during the past year. The financial position disclosed in the balance-sheet is good, and general progress has been satisfactory.

The president, Mr. S. H. Panter, is presenting a cup for yearly competition among the members, a gesture which, naturally, has been warmly received by all concerned. Due to friendly relations with the local municipal authorities, a piece of land has been secured on which it is proposed to lay a multi-gauge track and a race car track, so the society will be able in due course to offer an additional amenity.

The model railway section has recently increased its membership, and the construction of a sectional, portable "OO"-gauge track has begun. There is a reasonable amount of motive power available but, as yet, comparatively little rolling-stock. Members of this section recently visited the "OO"-gauge portable layout owned by the Coventry Model Engineering Society, whose members went to considerable trouble to make the visit an enjoyable one, thus forging another link in the strong bond of friendship existing between the two societies.

Chief attention at present is concentrated upon the exhibition to be held at the County Mining and Technical School, Coton Road, Nuneaton, from April 10th till 15th next. Competition sections will be introduced this year, and classes will be: (1) General Engineering Models, including race cars, hydroplanes and workshop equipment; (2) Locomotives of any type from Gauge "1" upwards; (3) Locomotives, rolling-stock and railway equipment for "O" and "OO" gauges; (4) Ship models of any type except hydroplanes, and (5) Junior Class, open to entrants up to and including 17 years of age.

Obituary

● IT IS with very deep regret that we have to announce the death, on March 7th, of Dr. John Bradbury Winter. He had been in failing health for many years and bed-ridden since 1945.

Dr. Winter was one of those indefatigable workers whose name, at least, is known wherever there are model engineers; he had a natural aptitude for mechanics, and was fond of scheming out original mechanisms or unusual arrangements of mechanical components. He loved locomotives, and the first model to bring him universal fame as a model engineer was the remarkable 1-in. scale replica of the L.B. & S.C.R. 0-4-2 engine, *Como*, which must ever remain a classic of its kind. The silver model of George Stephenson's *Rocket*, now in the library of the Institution of Mechanical Engineers is a unique and outstanding example of Dr. Winter's work. These two alone are enough to ensure their maker's everlasting fame; but there were other masterpieces, such as a perpetual calendar in the form of a mechanical signal locking-frame, and the more recent Congreve clock, of which the construction was fully described in our pages, by Dr. Winter himself in 1946, the article and the very-fully-detailed sketches for the illustrations being mostly prepared in bed.

Personally, Dr. Winter was one of the most charming of men; he had a keen appreciation of the difficulties of fellow-enthusiasts less fortunate than himself, and was ever ready to do anything in his power to help. His extraordinary mental alertness was preserved to a remarkable degree, and he never lost his manipulative skill and unusual delicacy of touch. He had the knack of being able to pass on to others something of his own facility, and anybody who had the good fortune to work under his guidance could hardly forget the experience. By his death, our hobby loses one of its most able, most celebrated and most genial of its craftsmen, one whose like will probably never be seen again.

A $1\frac{1}{4}$-in. Scale Burrell Traction Engine

by G. R. Cross

READERS will no doubt recall my writing in these pages of April 24th, 1947 issue, describing the building of this engine. Well, here she is in all her glory and I hope will quench the thirst of all traction fans !

As can be seen by the photographs, I have fitted and made many more bits and pieces. hind road wheel (right-hand side looking from the tender). Steam is taken from backhead top of the boiler in true Burrell practice. Steam is also supplied from this fitting to the pressure gauge and water lifter. The pressure gauge is $\frac{5}{8}$ in. diameter and reading to 120 lb. per sq. in.

The water gauge is all built up and brazed

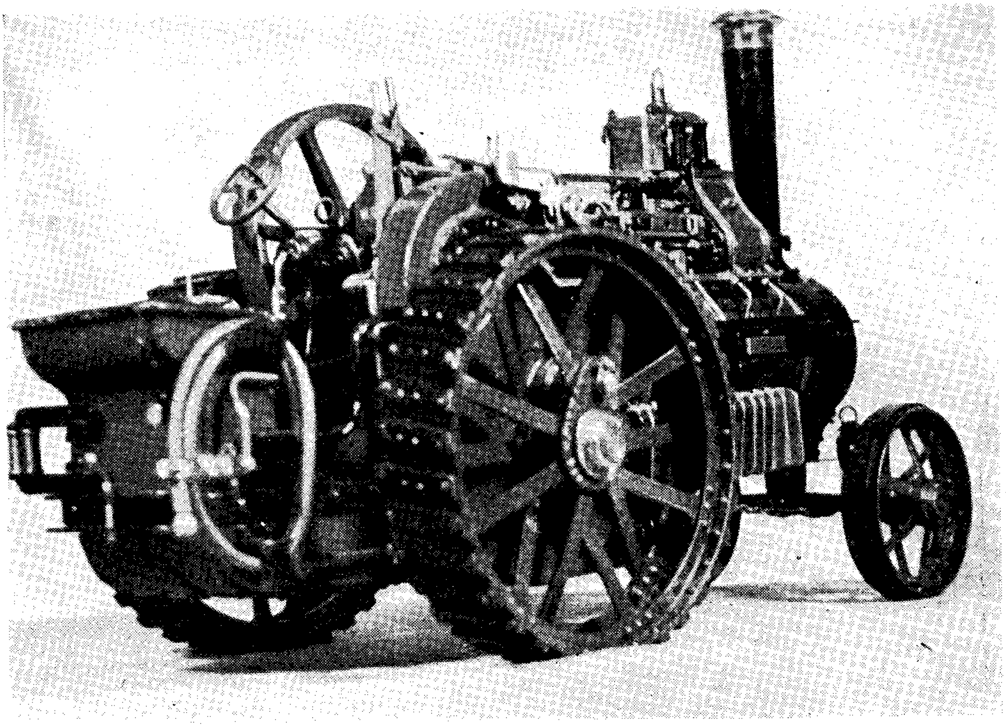


Photo by] [T. Thurston

A side end view of the scale model Burrell

The gear striking mechanism is all built up and brazed (two speeds and free position). The crankshaft has four keys ; to these are fitted the high and low gear pinions. Eight of these keys are fitted to the big engines. Compensating gear is fitted and is double geared on last motion, all gears are made from mild-steel blanks. Governors are the well-known "Pickering" type ; these are built up, the bracket being cut from solid steel. I managed to get the loan of one of these brackets from a traction engine proprietor friend of mine, who also loaned me an injector to copy. I did not adopt the latter, but followed our friend "L.B.S.C." This fitting is tucked away between the hornplate and and $\frac{3}{16}$ in. glass fitted. A blow-down valve is also attached. The feed pump is a gun-metal casting of my own design, has a $\frac{3}{16}$ in. plunger, stroke $\frac{3}{8}$ in., is driven direct from the crankshaft by an eccentric, all joints have glands, the plunger gland is packed with graphited yarn, also the cylinder glands. All the valves are rustless steel balls, and have a return valve and cock.

The break on the main spur wheel is operated by a handwheel and is made of mild-steel. This is fitted on the left-hand side of the tender. Burrells had other ways of fitting brakes to their engines and fitted quite a number of them with the brake operating on the intermediate shaft, the brake drum being fitted and bolted to

the double spur ring. Burrell engines differ in many respects as regards fittings. There were not many alike; it may have been due to some particular purchaser. I know the show people had their special fancy, and alterations were made to suit them. Cylinder drain cocks are fitted and have a long reach lever which the driver controls from the tender. Stephenson valve gear is employed as is standard on most traction engines, the usual reversing gear being fitted. Oil cups are fitted to all working parts and were machined from brass rod. Steel pins of valve gear, crosshead gudgeon pin and small end, are all case hardened. Guide rollers for steel wire rope were machined from the steel rod and bracket (angle) made from 16-gauge mild-steel plate. I fitted the usual hand-operated water cock, which controls the water from tender tank to injector, and the usual long lever ashpan air regulator flap. This is also under the driver's eye. Steering is by the usual worm drive and chains and shackles are fitted, also the safety chain preventing front wheels from fouling boiler. Talking of the boiler, this is the second for this engine. The first was made many years ago, before I had really got my eye on one of these engines of this particular type. Incidentally, I would like to mention, this engine was in its half-way stage then, and up to about two years ago. I was fortunate enough to get hold of a blueprint, giving an elevation view, gear side of this engine. I then found that all the motion parts were on the short side, also the boiler was $\frac{3}{4}$ in. short. I decided there and then, it had to be a new boiler. The tube arrangement was altered, the first boiler having twelve $\frac{3}{8}$ in. o.d. copper flues. I would like to mention that this boiler fired splendidly. The second boiler has one $\frac{3}{4}$ in. flue tube and six $\frac{7}{16}$ in. o.d. flues. I have had a good solid fire going and 100 lb. of steam pressure in a very short time. The steam blower was dead on and keeps a very nice fire going when engine is not working. The boiler is lagged with asbestos sheeting and 22-gauge zinc, which covers this and the usual brass bands, to take care of this. You will notice I have fitted the oil drip tray under the piston rods and valve rods; $\frac{1}{8}$ in. brass tube is fitted to this and runs under the boiler and carries away all used oil and water that may find its way through the piston and valve glands.

Inspection platform and toolbox is fitted; name-plate is not yet engraved. The valve chest has not the usual Burrell brass breast plates with the manufacturers' name engraved on same. I am going to remake this valve chest cover with brass plates and engravings.

Hose pipe is fitted together with strainer or rose; the rear lamp is there, also two front lamps. You will notice the spuds on the rack. I am sorry to say we hardly ever see model traction engines showing the latter accessories. A traction engine is not complete without these, and it is good to see all fitments on any type of model.

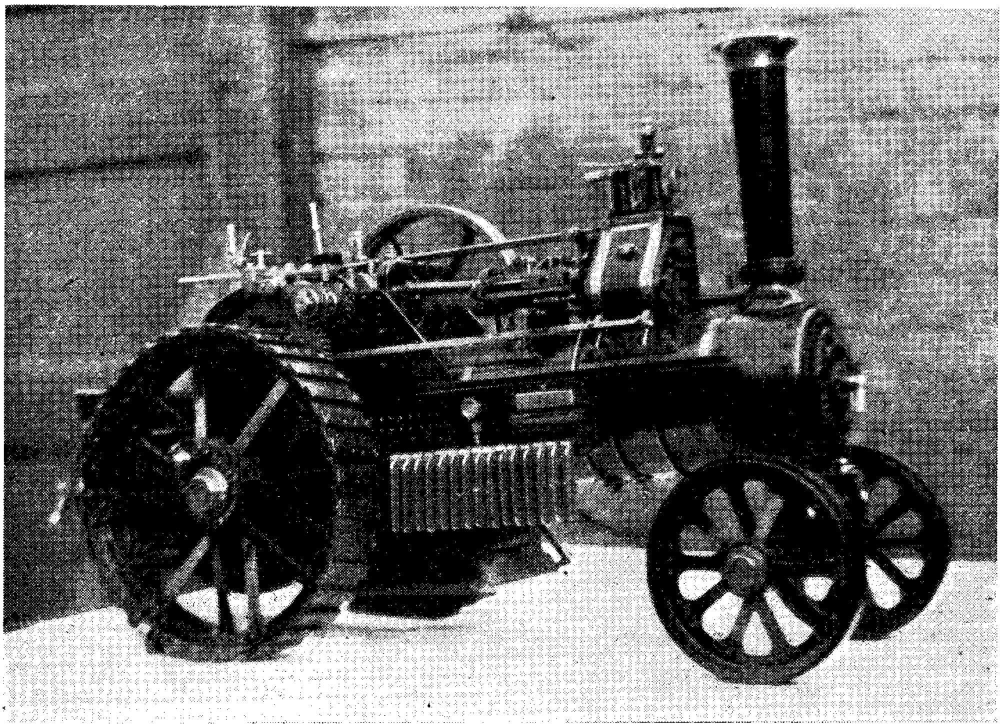


Photo by] [*G. S. Capes*

An off-side view

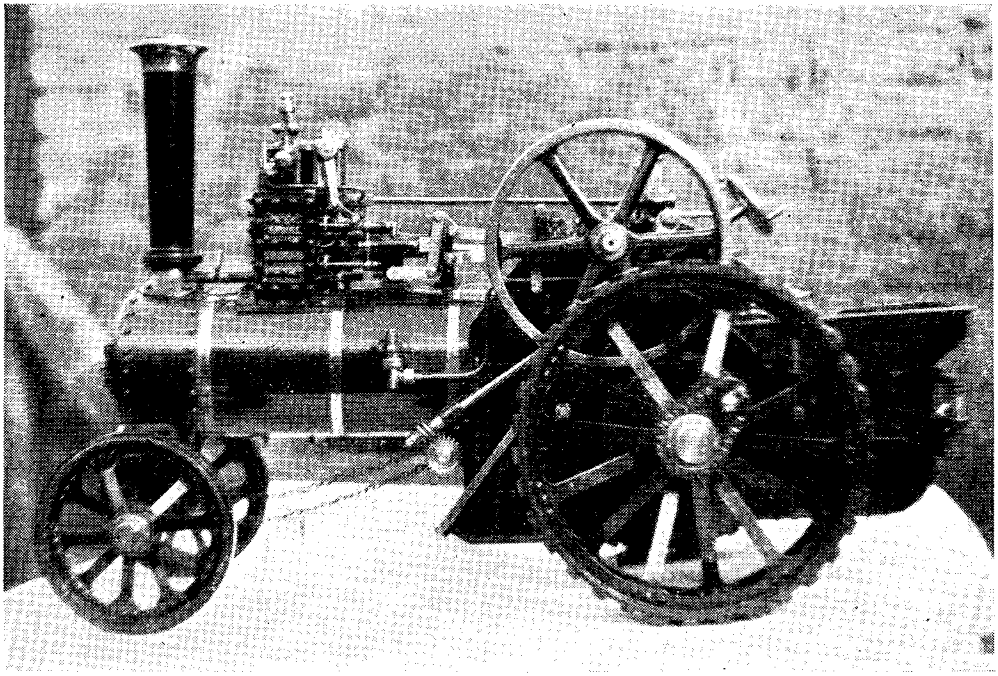


Photo by] [*G. S. Capes*

A near-side view

All gears have the usual casings made from 20-gauge sheet-iron and welded.

Mechanical lubricator is fitted and made per "L.B.S.C." words and music, and works perfectly although rather on the large size. The size of the container has been cut down; it has a 60-tooth ratchet wheel, and is operated by the high pressure valve rod. There is a check valve on top of cylinder and one at the lubricator end; rustless steel balls are fitted.

I hope the photographs will interest all, and I would very much like to see more of these grand old engines in model form appearing in these pages.

This engine has taken me many years to build. I did very little to it during the war years and spent a lot of time getting details of this type of engine. This necessitated making many trips into the country. It pays one well to get one's eye really fixed on the type of engine one has in mind to build, and to work every possible detail into one's models. It is detail that counts in a model.

My next traction engine is going to be a 3-in. scale, and I have already got some of the details out. The boiler is going to be all of steel, electrically welded. The T-wheel rims will be rolled locally and all castings will be made in my home town. For those who may be interested I will give the main dimensions of this future engine.

Overall length 4 ft.; width $22\frac{3}{4}$ in.; height 33 in.; 13 in. diameter flywheel; boiler 26 in. long, $6\frac{5}{8}$ in. diameter; rear wheels $17\frac{1}{4}$ in. outside diameter, fronts $10\frac{3}{4}$ in. outside diameter.

Traction Engines at Work

Mr. L. E. Boll writes:—"You may be interested to learn that at the 'Onion Fair' recently held on the Serpentine Ground, Aston, Birmingham, Messrs. Pat Collins had no fewer than six steam traction engines operating—two Fowlers, two Burrells, a Foster and a McClaren.

The McClaren, named *Goliath*, was built for hauling guns in the first world war and still bears marks made by shrapnel. On the cessation of hostilities, the engine was bought by Messrs. Pat Collins together with a special permit to enable it to be used on the road, since it is no less than nine feet wide over the back wheels.

One of the Burrells was renamed *Griffin* last year, having been rebuilt by Messrs. Hunt Bros., Griffin Foundry, Oldbury, and fitted with a new firebox, a new flywheel, and a pump, it having been previously working with injectors only.

At this fair, the quite steady running of the steam engines was most noticeable, since there were several diesel generators working in close proximity and making their usual clatter."

Further Notes on an Electric Clock

with a Semi-Free Balance

by Stanley J. Wise, F.B.H.I.

THE series of articles on the above subject, published in THE MODEL ENGINEER from November 10th to December 1st, appear to have created considerable interest and well-meant criticism. In this connection many letters have been received from enthusiastic readers—in one case as far away as Wellington, N.Z. — all of which goes to show the keenness and inventive mind of the present-day model engineer.

Apparently, the chief difficulty raised by the average constructor is the lack of full assembly drawings showing the disposition of various components on the finished instrument. At the request, therefore, of numerous readers and the

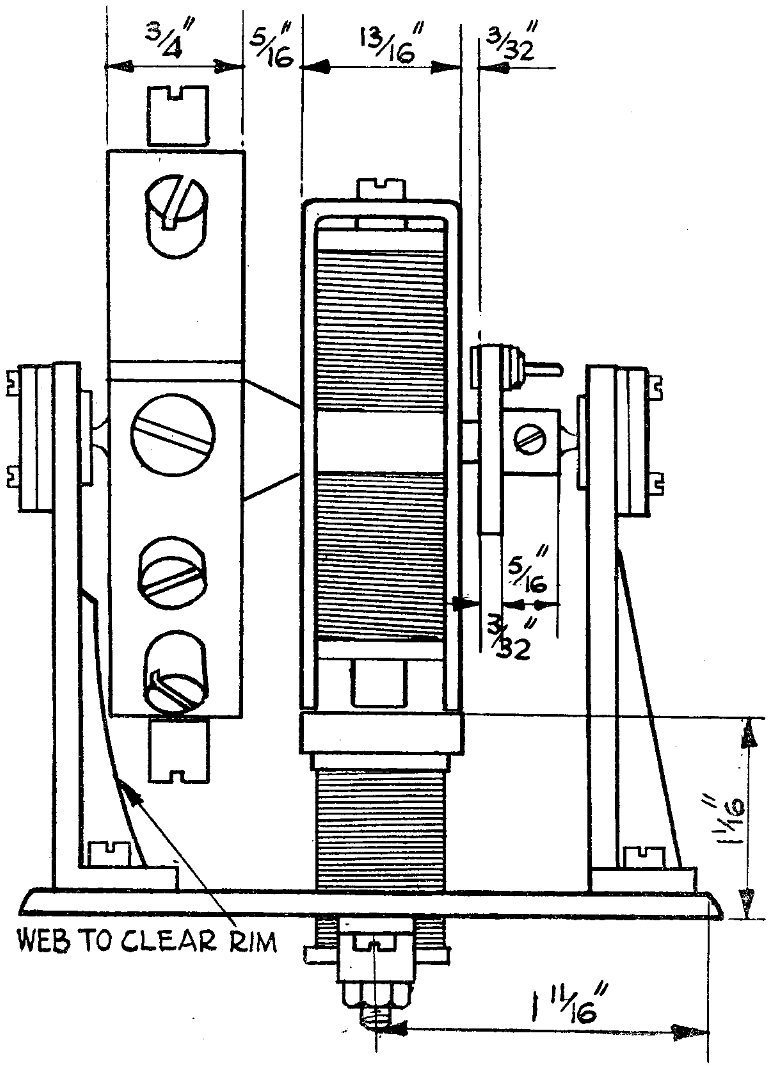


Fig. 1. General side view assembly

kind permission of the Editor, I propose to make good this deficiency in the hope that all essential points will thus be made clear.

Fig. 1 is a full-scale side view showing all essential balance components in finalised positions. It will be seen here that all sub-assemblies fit the staff, length between pivots, with a clearance of 3/32 in. between roller disc and coil plates, and 3/32-in. pivot shoulders. There is, however, the question of front pedestal web fouling the balance rim ; this latter must be suitably " swept " to clear as shown, or, alternatively, two short webs—one on each side—would allow more freedom. After all, the part actually strengthened by the web is the anchorage plate of pedestal to its main plate.

Fig 2 represents a front view of the mechanism with upper portion of coil cut away to expose an outline of contact switch and supporting column. All dimensions here are expressed as on original component drawings ; noteworthy, however, is the disposition of contact assembly, which can be adjusted both in a vertical and horizontal plane—a very necessary combination when such critical final setting is required.

Fig. 3 shows a double-sized picture of the switch assembly, from which it will be seen that switch arm assumes a position at approximately right-angles to its mounting plate ; fine adjustment of its finalised position can be obtained by slightly bending it, near its pinned anchorage, up or down as the case may be ; this should, however, only be attempted during final checking under actual working conditions.

Fig. 4 represents a side view of the various assembled items, more especially should the position of insulating bushes be noted, thus allowing the switch lever, its pivot and spring anchorage to be completely insulated from the frame.

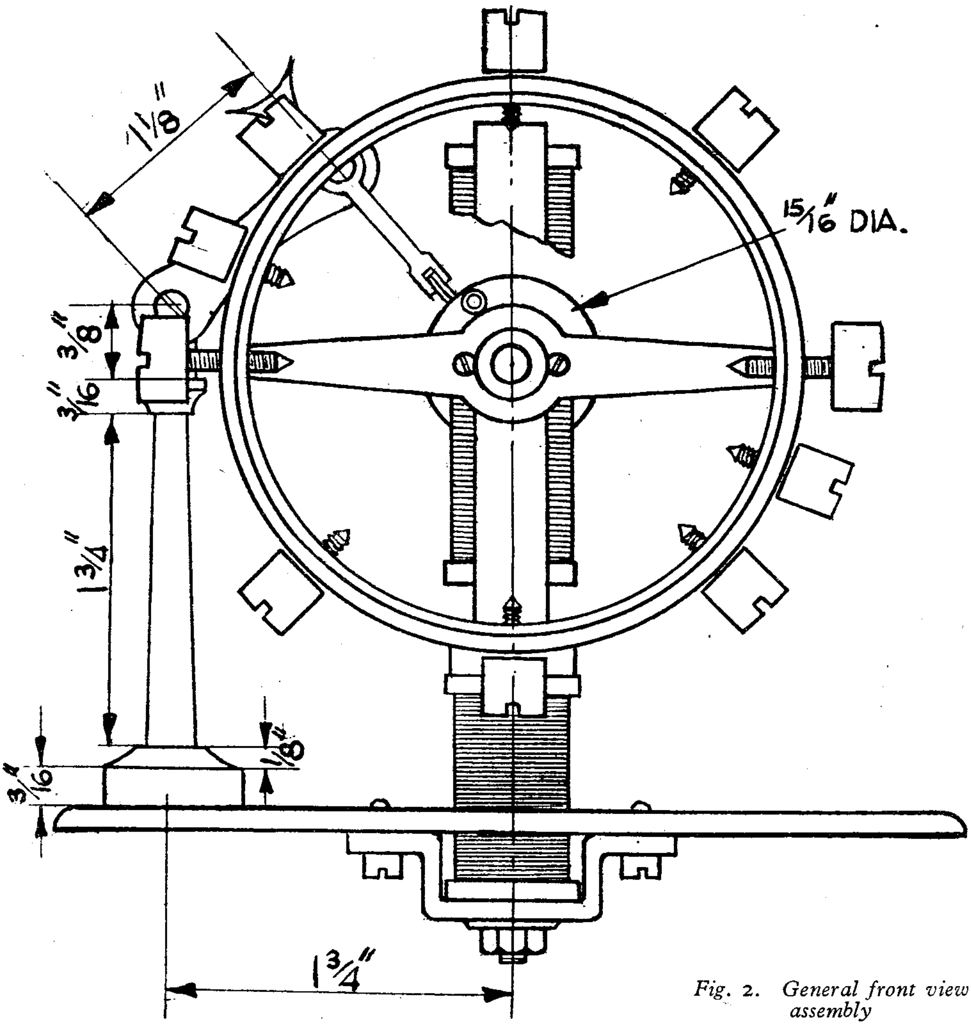


Fig. 2. General front view assembly

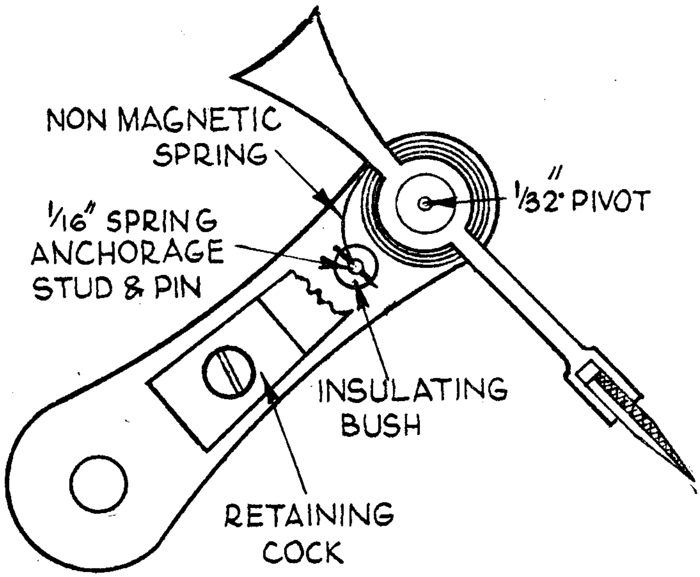


Fig. 3. *Front view of switch assembly* (*twice full size*)

We now come to Fig. 5 which, according to many readers, is bristling with "snags," chiefly owing to insufficient area accommodating the wheel-work, plus propulsion gear. In the original clock, made some years ago, it was found necessary to overhang the electro-magnet coil by $\frac{1}{8}$ in. below the lower edge of pedestal, even so, the centre ornamentation on front-plate had to be bent slightly outwards forming a curve over the coil ; it looked quite pleasing arranged in this way. Reverting to Fig. 5, here is a full assembly view of the front pedestal and dial impulsing mechanism. A close examination of this will show that ample area exists to accommodate all components, but one or two amendments are necessary if the coil is raised and, indeed, these will bring about a definite improvement both in simplifying the propulsion mechanism and also allowing ample room for return spring and electro-magnet. Here are the amendments :—

1. The length of $\frac{15}{16}$ in., representing *inside* measurement of coil, should be the overall length taken *outside* flanges.

2. Front-plate shortened considerably by decreasing the lower radii and ornamentation.

Remaining points are :—

(*a*) Only one stop-pin is necessary since the propulsion-pawl nose-screw performs both stop and locking functions.

(*b*) Return-spring anchorage-lug disposed under centre wheel, at which point there is ample room.

(*c*) End of return spring bent round to embrace top of rocker, thus imparting an inward pull.

(*d*) Separate pillar for nose-screw unnecessary; drill and tap existing column as shown. Make 10-B.A. nose-screw of *steel* with well-rounded tip.

(*e*) Leave a lug of about $\frac{3}{16}$ in. radius at $\frac{9}{16}$ in. from balance axis on the right-hand edge of pedestal, this will allow a full length backstop to be used.

(*f*) Should be 7/32 in. × $\frac{1}{8}$ in.

(*g*) The two lower pillars are now disposed 7/32 in. below centre-line and pitched $\frac{15}{16}$ in., while the top column is slightly less than originally—namely, $1\frac{1}{16}$ in. from centre wheel.

(*h*) Lower circumference of centre wheel has ample clearance at the back curve of coil.

Several readers have stated that it is impossible to insert the $\frac{13}{16}$-in. × $\frac{5}{8}$-in. pole track of fixed coil through a $\frac{3}{4}$-in. hole in base-plate. This, of course, is obvious, as I should also imagine the correct method to be : namely, remove coil from its bracket and insert from top of plate, after swinging balance sufficiently to allow for entry. Leave bracket loosely attached while doing so. The two 4-B.A. anchorage screws are pitched at $1\frac{5}{16}$ in.

The motion wheels were not detailed on the drawing, for the simple reason that these can be of any reasonable size ; for example, those taken from a large pocket watch of the cheaper kind would suit, or a $2\frac{1}{2}$-in. clock may offer a "find." In the latter case, however, bushing will be necessary.

A new centre-wheel arbor will also be required which can conveniently be made from one taken from a discarded "Bee" clock and reduced to

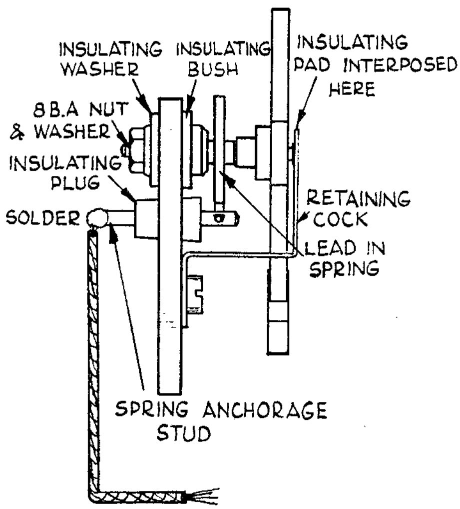


Fig. 4. *Side view of switch assembly* (*full size*)

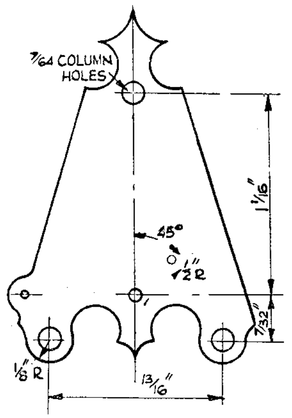


Fig. 6. Front plate

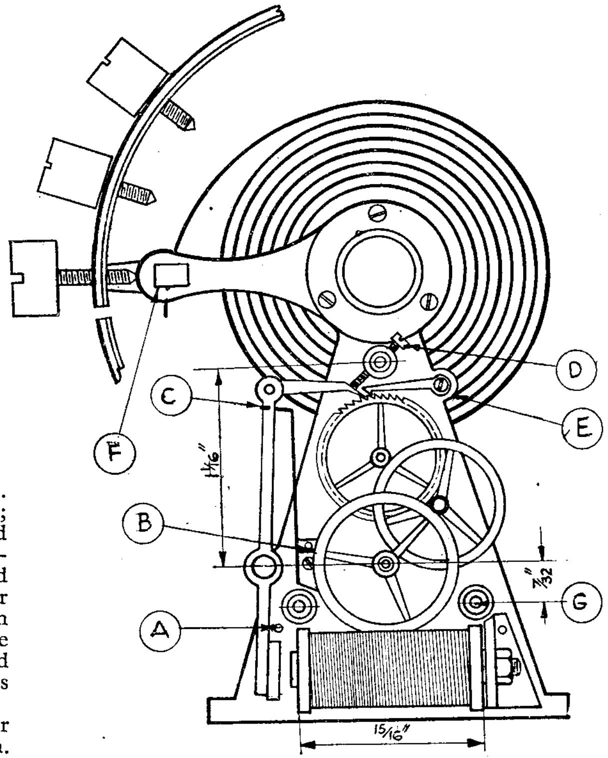


Fig. 5. Dial mechanism assembly

fit the pivot holes and centre wheel. This should present no difficulty; leave about $\frac{1}{2}$ in. projecting for hand attachment, hour wheel and minute-drive pinion. The minute hand should be a tight fit and "tapped" on after centre wheel and other items have been assembled to front-plate; in this case the chapter ring will be assembled *after* the hands are fitted. There is ample width in the ring to clear.

The dial, or more correctly, "chapter ring" should not be more than 3 in. diameter as measured over numerals; this should allow a margin of about $\frac{1}{4}$ in., making a total diameter of $3\frac{1}{2}$ in. With a centre hole of about $1\frac{3}{4}$ in., the movement will be exposed to the best advantage. Anchor the dial at two points in the form of lugs clamped under each baseplate finial, using countersunk 8-B.A. screws for attachment with nicely rounded and polished heads.

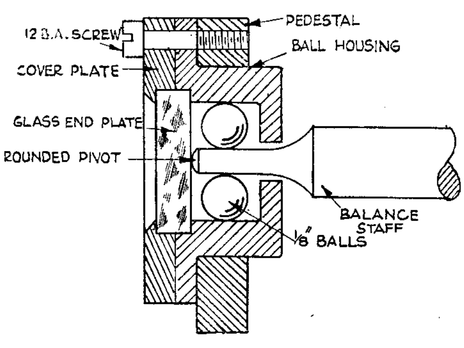


Fig. 7. Assembly of ball-bearings

Fig. 6 shows the front-plate after amendment; it is recommended, however, that all holes other than the centre wheel should be drilled through from the pedestal using the latter for a jig.

Fig. 7 represents an assembled sectional view of one main bearing. This has been re-drawn from a print supplied by reader S. W. Coulter, of Belfast, who appears to be a very keen constructor.

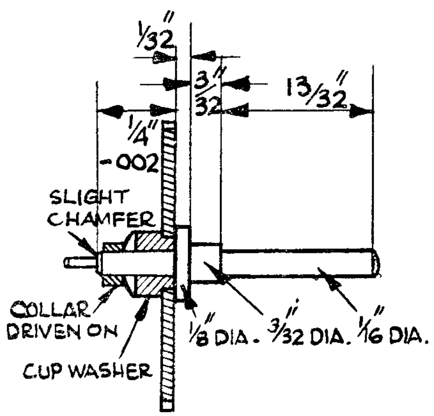


Fig. 8. Centre wheel assembly

Fig. 8 shows the centre wheel and arbor with friction-set hands spring.

It has been suggested by certain readers that erratic impulsing might occur when the clock is

(*Continued on page* 426)

Novices' Corner

A Tool and Work-Stand for the Lathe

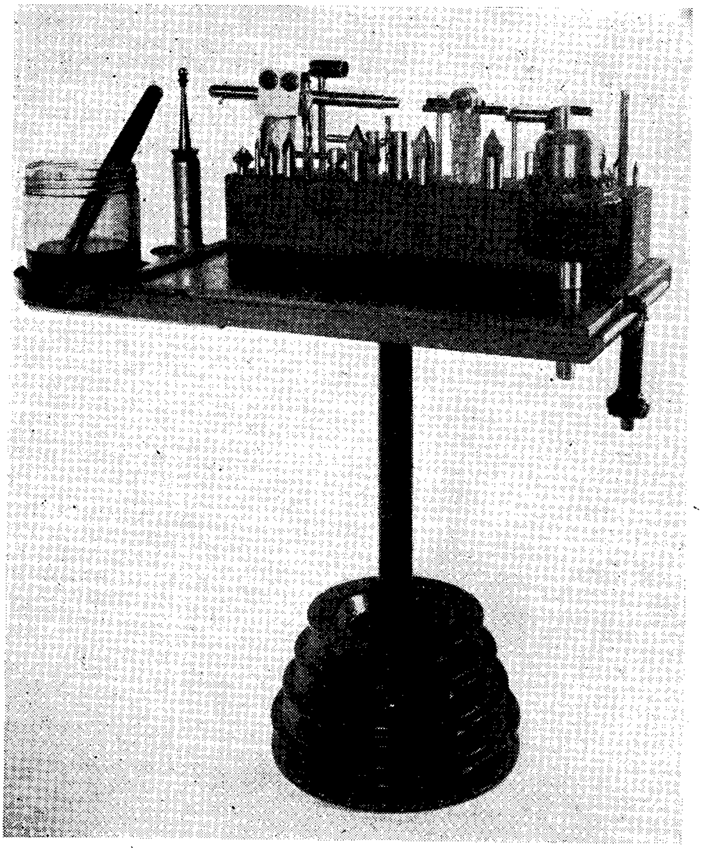


Fig. 1. *The complete tool stand*

THIS stand, which has been in use for many years, has now come to be regarded as an essential adjunct to the lathe.

As will be seen in the photograph in Fig. 1, the small tools and fittings used in connection with the lathe are housed in a rack mounted on a tray. The tray is supported by a leg attached to a foot-piece; this enables the position of the stand to be changed at will, although normally it stands on the bench at the back of the lathe, towards the tailstock end of the bed, and out of the way of the saddle. It may be remembered that in a previous article it was advocated that the lathe spanners and keys should be mounted on the front of the bench, thus placing these tools ready to hand and enabling the lathe to be used while the operator is seated.

The stand here described carries this idea further and also makes provision for the safe storage of the smaller tools and fittings. The lathe accessories normally carried in the rack are the lathe centres not in actual use and any small box spanners, Allen keys and tommy bars; besides these, small boring bars mounted in their holders will be handily placed, and a selection of centre drills, pilot drills and countersinks should be included.

The main purpose of the tray is to provide a convenient and safe place for putting partly finished work, but, in addition, the tray forms an ideal place for the micrometer, where it is out of harm's way and unlikely to come into contact with metal chips. The micrometer is a delicate and costly instrument that is largely responsible for ensuring accurate workmanship, and it is hardly prudent, therefore, to rest it on the lathe bed or to deposit it amongst the swarf on the bench.

As will be apparent from the photograph, the tray is useful in other ways, for at its right-hand end, opposite the tailstock, the tailstock chuck is supported by means of its arbor, and the chuck key is mounted close at hand. On the left, a jar of cutting oil is conveniently placed and, behind it, an oilcan serves as a reminder that the mandrel bearings require lubrication each time the lathe is used. Before embarking on a machining operation in the lathe, it will, as a rule, save time if the small tools required, such as taps, dies and drills, as well as pieces of material, are first collected and then set out in order on the tray ready for use. Again, when making batches of small parts, screws and nuts for example, it will make for orderly working if a number of tin lids are placed on the tray and the parts are transferred from one to the other as the machining proceeds. It must not be forgotten that there may be a drilling machine mounted at the other side of the bench; if so, the stand will also serve to carry a set of centre drills and other small tools for use in this machine.

Making the Stand

The tray is best made of hard wood such as oak or mahogany, and the upper surface may be

finished either by treating it with linseed oil, or it may be waxed with floor polish or highly finished by French polishing.

To prevent small parts or tools rolling off, a shallow beading should be fitted round the edge of the tray as shown in Fig. 2; the small, rectangular-section strips of walnut, marketed by Messrs. Hobbies under the name of Stripwood, have been found to serve well for this purpose. A hole should be drilled in the tray to accommodate the arbor of the tailstock drill chuck, and the chuck key is carried on a pair of wood screws, as illustrated in the photograph. A wooden shelf is attached to the under side of the tray at its left-hand end, and to this two tin lids of suitable size are fixed with wood screws; these lids serve as small drip trays for holding the oilcan and the glass jar containing cutting oil.

The method of making a tool stand from a wooden block was described in a previous article but in this instance a miscellaneous lot of tools and fittings has to be mounted, and the stand must be marked-out and drilled accordingly.

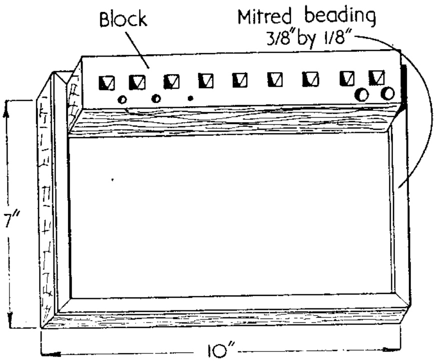


Fig. 2. View of the tray and tool rack

It will be seen in the photograph that, amongst other accessories, a set of centre drills and the lathe centres are carried at the front of the stand. The drills are held in holes bored slightly oversize and the coned centres can also be mounted in this way, but if the corresponding Morse taper reamer is available, it is better to use it to make these holes of tapered form

Tools with square shanks can quite well be mounted in round holes or, as an alternative, the holes can be drilled under-size and then squared up with a wood chisel.

As illustrated in Fig. 3 the leg carrying the tray was made from a length of conduit tubing, threaded at its upper end for a conduit flange which was fixed to the tray with wood screws, but a leg made of round- or square-section wood will, of course serve equally well.

To afford the necessary stability, a heavy footpiece or base is required; in the example shown, this consists of a discarded belt pulley which was secured in place on the tubular leg by means of its own Allen grub-screw.

Those who do not happen to have a suitable ready-made base can easily make one in the following way, and as illustrated in the drawings. A wooden base is constructed to enable a second conduit flange at the lower end of the leg to be attached with wood screws. The requisite stability is obtained by running lead into a recess formed on the under side of the base, as represented in Fig. 4. To form keys for holding the lead in place after it contracts on cooling, four wood screws are inserted with their heads lying below the level of the base surface. When a single large cavity has to be filled with molten metal at one pouring, this entails using a large melting ladle. To overcome this difficulty, a small ladle can be employed if a number of small holes are used, instead of one large cavity, and the

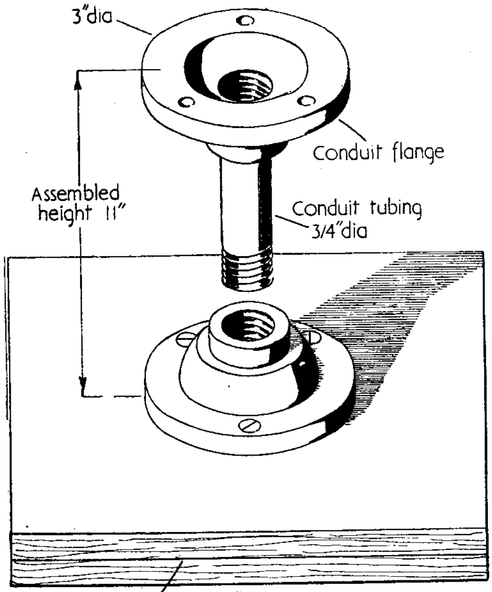


Fig. 3. The table leg and boss

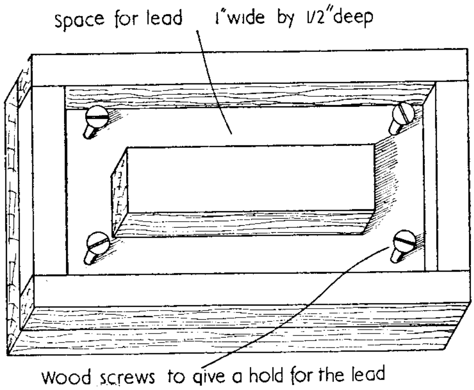


Fig. 4. View of the underside of the base, showing the recess for lead filling

work of filling is carried out in stages. These small cavities can readily be bored on the underside of the base by using a brace and bit and, as shown in Fig. 5, a wood screw is again employed to fix each lead plug in position.

At the outset, care must be taken to ensure that the wood is dry, otherwise the hot metal will form steam which will cause spluttering of the molten lead, and thus, possibly damage to the person or clothing. The lead is heated in an iron ladle on a gas ring until it becomes just molten, and before pouring, the surface dross should be skimmed off. The cavities should be well filled to allow for the contraction of the metal on cooling; any surplus metal can then be easily removed with a knife or chisel to make the surface flush.

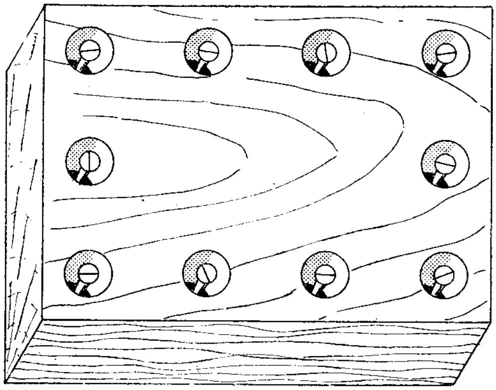


Fig. 5. Alternative form of lead filling

Some charring of the wood will, of course, take place, but this will be much reduced if a hard wood such as oak is used for the base. Resinous woods, like pine, are apt to catch alight when the hot metal is poured in, but the flame is easily extinguished and no serious consequences need be anticipated.

An Electric Clock with a Semi-free Balance

(*Continued from page* 423)

energised by a.c. current by reason of contact periods not always being in phase with the cyclic changes of the supply; in other words the switch may actually make contact at say a peak on one power stroke, but may be displaced to zero on the next impulse and so on.

This question can best be answered by the following :—

The whole effect of impulsing with such a system depends (other things being equal) upon the total number of cycles presented by the pole track in a given time, which, of course, is again governed by a suitably prolonged contact period.

Now the r.m.s. (root mean square) value of e.m.f. expressed in watt-seconds represents the energy applied to a circuit of this type and, in this case, is limited by the length of track and period of contact, no matter at which part of the cycle energisation starts, the watt-seconds consumed will remain the same, although there may be a negligible phase displacement due to high inductance of the coils. The watt-seconds value cannot vary provided the time and distance covered is constant. As an example, assume the balance to be performing its impulsing arc, the time taken for pole-piece to travel its track is approximately 0.150 sec., during which period 7.5 cycles have reacted. It should be remembered that at any instant during the magnetising period poles of opposite sine are presented to the pole-pieces respectively; thus, with an r.m.s. value at 50 cycles, the phase displacement is actually less than half a cycle or 1/100 sec. I mention *actually less*, because r.m.s. values cancel out the negative sines to a large extent. There are, of course, other factors, such as power factor and hysteresis which, fortunately, are, in the present system, of a fairly constant nature.

There is just one more question. Don't be afraid of cutting off several coils of control spring; this will be found necessary when carrying out preliminary timing tests.

May I again thank the numerous readers for some very constructive letters, although a few queries raised would require much time to answer fully and I am not quite so "tough" now as 20 years ago.

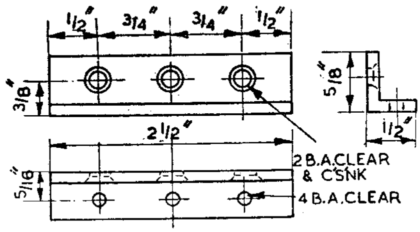
Answers to later queries. Be sure that both sections of balance coil are wound in the *same* direction, otherwise *neutral polarity* will result.

Resistance of main coil equals about 200 ohms, while that of fixed coil is approximately 100 ohms.

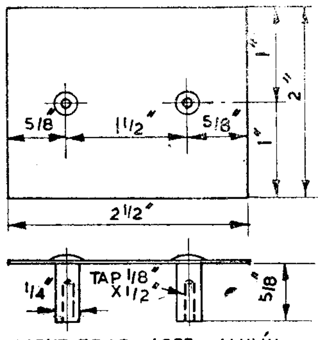
*Miniature Slide and Strip Projectors

by "Kinemette"

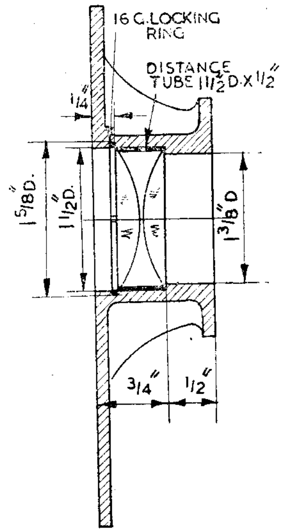
DETAILS of the fittings for carrying the lamp and reflector are shown on page 429, and it will be seen that while they are generally similar to those used in the "M.E." Home Cine-projector, they are not identical in all respects. These fittings may seem to be needlessly complicated, and it is quite true that both of which are vertically adjustable. The lampholder clamp is designed to grip a standard pattern bayonet lampholder, either of the single- or double-contact type, and its dimensions may have to be adapted to the particular holder employed. This component also is equipped with two parallel rods, which are a sliding fit in



ANGLE BRACKET - 1 OFF - L. ALLOY



LIGHT TRAP - 1 OFF - ALUMN.



SECTION THROUGH CONDENSER HOUSING SHOWING METHOD OF SECURING LENSES

it is possible to make them much simpler, if one decides from the outset exactly what type of lamp is to be used, and does not wish to provide for any possible change which may subsequently be made. In short, the idea is to make the fittings adaptable, as far as possible, to take various types and sizes of lamps, and methods of mounting them in appropriate holders; and where there is the likelihood of any experimenting in this respect, the trouble of making the components up will be found well worth while.

The entire lamp carrier assembly is carried on two parallel rods screwed horizontally into the back of the condenser housing flange; these may be made either of mild-steel or brass, and are specified on the drawing as adjustment rods. Arranged to slide on these rods is a piece of channel-shaped brass, which can be clamped at any position along their length, and this in turn carries the lamp bearer clamp and mirror clamp, holes drilled horizontally through the lamp bearer clamp block, thereby providing fore-and-aft adjustment of the lampholder. The materials from which these components are made need not necessarily follow that specified in the drawings, as they have to withstand neither heavy strain nor running wear, and steel, brass, or light alloy may be used at the option of the constructor.

Adjustable Support

A piece of channel-section material is most convenient for this part, but if such is not available, it may be bent up from either light alloy of "half-hard" brass sheet, about 3/32 in. thick (in either case annealed before working), using a piece of $\frac{5}{8}$ in. square or rectangular steel bar as a former. After trimming to correct shape and size, the horizontal holes are drilled through both flanges, with great care to set them out at exactly the same centres as the tapped holes in the condenser housing. If, however, any error should happen to be made in this respect, it is quite permissible to file out the holes to correct

*Continued from page 363, "M.E.," March 16, 1950.

it, as a neat sliding fit of the holes on the rods is not essential.

A hole is drilled and tapped in the centre of the top surface to take the vertical rod, which is screwed home as far as it will go, and in order to prevent it from working loose in the rather thin material, it is advisable to sweat it in, taking care not to get solder on the lower part of the threads. Sweating is not practicable if light alloy is used, so the alternative is to fit a lock-nut to screw up to the underside of the channel, the essential object in any case being to ensure that the vertical rod is supported rigidly on the channel piece.

The loose clamp plate is simply a flat plate 3/32 in. thick or slightly more, and $\frac{5}{8}$ in. wide, with a central $\frac{3}{16}$ in. hole to clear the end of the vertical rod. It is held in place by the knurled securing nut seen in the bottom centre of the group, which presses the clamp plate against the underside of the adjustment rods, and may be used either to adjust the friction or clamp the support firmly in place. Note that a really tight grip is not necessary for these fittings, and it is often found convenient to leave them partially slackened off, so that frictional movement is possible, until all adjustments have been determined, and then tighten them just sufficiently to prevent accidental displacement.

Lamp Bearer and Mirror Clamps

The former may be made of square or rectangular bar, not less than $\frac{3}{8}$ in. across the smaller dimension, and $1\frac{1}{2}$ in. long. A $\frac{3}{16}$-in. hole is drilled and reamed vertically through the centre, to fit neatly on the vertical rod, and three holes are drilled horizontally to take the lamp bearers and the knurled clamping screw respectively. It has not been found necessary to fit clamp screws to the holes which take the bearers, but they may be added if desired ; in which case they may either be fitted vertically over the holes, or the bar may be made a little longer to allow of drilling and tapping the clamp screw holes from the outer ends.

The same material may be used for the mirror clamp, though a round bush could be substituted if found more convenient. It is similarly drilled and reamered vertically to slide on the rod, and cross drilled for the clamp screw, which is practically identical with that of the lamp bearer clamp, and in this case is shown in position. The hole is drilled and tapped right through the block to take the short screw which secures the mirror clip.

It may be found desirable to modify the shape and size of this clip to suit the particular concave mirror used, but the essential thing is to provide just enough spring to grip the edges of the mirror and hold it in place, without stress which might cause it to crack when heated. Strip brass about $\frac{1}{4}$ in. wide by 1/64 in. thick is suitable, preferably of the hard-rolled variety, such as shim stock. Instead of two strips placed crosswise, as shown, a " spider " with three or four arms may be cut from sheet metal, curved and bent over at the tips in the same way.

The use of a concave reflector is not absolutely necessary in a projector of this type, and some users have stated that so far from being a benefit, it interferes with the focusing of the illuminant, and is liable to cause blistering of the film. There is no doubt, however, that a properly focused mirror increases the efficiency of illumination, and failure to realise this advantage indicates either that the focal length of the reflector is wrong, or that the method of adjustment is not properly understood. The fact is that the mirror enables the back surface of the lamp filament to contribute to the forward projection of the lamp beam, as well as the front. It should be focused so that the imaginary image of the filament is thrown back almost exactly to its starting point, but slightly displaced sideways or vertically, in such a way that if observed from the middle of the objective tube, there would appear to be *two* filaments very close together ; this visual adjustment can be carried out either with the lamp " dead " or energised with low voltage, just sufficient to produce a dull glow. In any subsequent adjustment, the distance between lamp and mirror should remain constant.

The 2 in. diameter concave mirrors, as used for the " M.E." cine-projector, give quite good results ; some readers may remember that it was later found possible to obtain a half-silvered lamp bulb, which made a separate mirror unnecessary, but these are not available at present, so far as can be ascertained. Mirrors larger than 2 in. are likely to be of too great a focal length to be capable of housing in a small lamphouse. The superior optical qualities of the Mangin type lens-mirror over a plain spherical-curved reflector, either of glass constant in thickness throughout, or surface-silvered, render it well worth the extra expense, if it can be obtained in suitable size and focal length.

Lampholder Fittings

The strip metal lampholder clamp should be made of material about 18- or 20-gauge, and the distance apart of the holes should be equal to those in the lamp bearer clamp. There is generally a tendency for the rods to spread when the nuts holding the circular clamps are tightened, and this tends to increase the sliding friction of the rods in the holes, which is quite a good thing, if not excessive. By using an encircling clip on the lampholder, it is possible to rotate the latter into the position which enables the lamp filament to be presented at the most efficient angle to the condenser ; any modification of the fittings which the constructor may find desirable should incorporate some means of rotating the lamp.

The complete assembly of lampholder and mirror fittings is shown in the photograph, and it will be seen that both the lamp and mirror are capable of independent vertical adjustment and side swing, and that fore-and-aft adjustment of both lamp and mirror can be carried out, either conjointly or independently.

If there is a choice between single- or double-contact lamps, the former is considered preferable, owing to the greater area of contact which is possible ; and firmer spring pressure can also be obtained and maintained. The tiny contact springs which must necessarily be fitted inside the plungers of double-contact holders often give trouble (and when they do, there is nothing that can be done about it but scrap the entire holder !)

especially when they are subjected to the combined effects of heat and heavy current flow. In the single-contact holder, it is possible to fit a substantial centre spring, and if the available types of standard holders are not found robust enough, a new centre—or, indeed, a complete new holder—is not a very difficult thing to make in the home workshop.

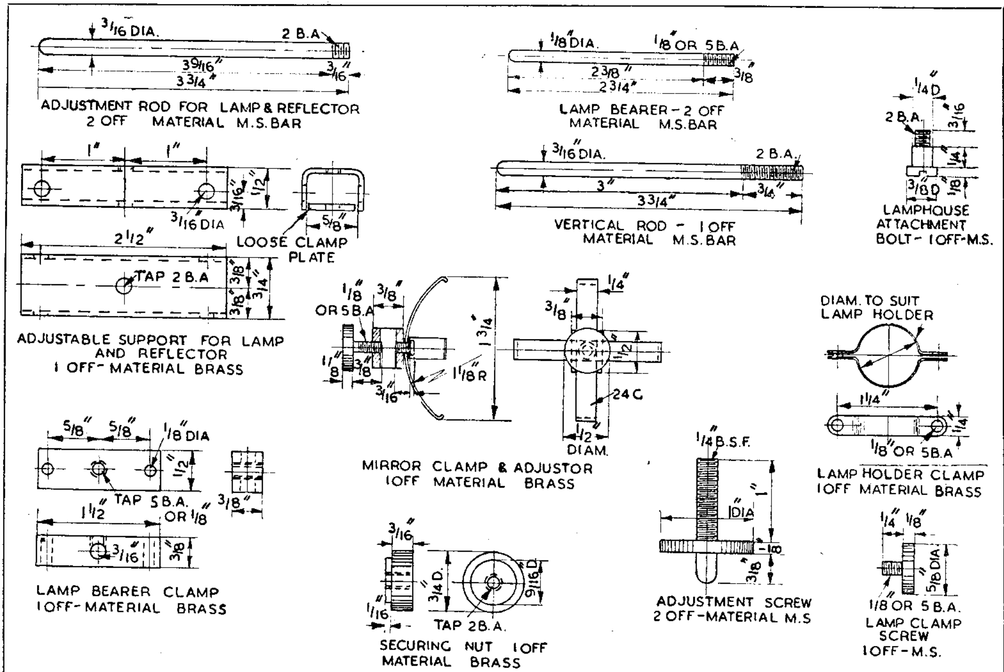
The lamp shown in the photograph is an exciter lamp as used for illuminating the photo-electric cell in the sound reproducing system of a "professional" 35-mm. cine-projector (as used in cinema theatres), which has been tried experimentally and found to give good results, but a motor headlamp bulb of about 36 watts is also suitable, or indeed any high-efficiency lamp with a compact filament, working on low or moderate voltage, such as can be obtained with available supply facilities. High voltage focus-filament lamps for direct mains supply are too long to be used in this projector, unless the design of the lamphouse is modified, but they can be used in the other projector, illustrated on page 261 of the March 2nd issue.

Why a Low-voltage Lamp ?

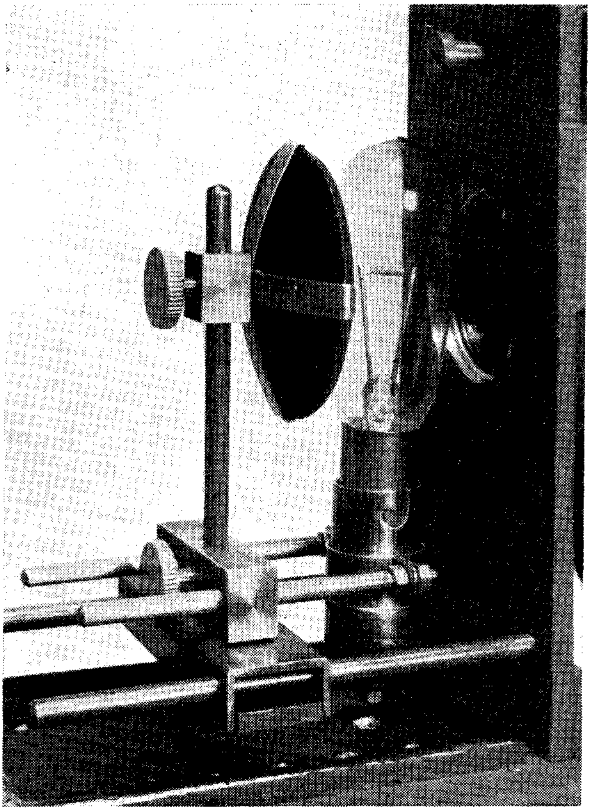
The reason for specifying that a low-voltage lamp should be used was fully explained when the "M.E." Home Cine-projector was described, but as there has been a great deal of criticism of this feature in the past, it will bear repetition here. Apart from obvious advantages in economy in the cost of bulbs, and compactness, which influences the entire lamphouse design, it can be demonstrated that when properly exploited, low-voltage lamps give much more efficient illumination *for this particular purpose* than high-voltage lamps, for a given wattage input. The special lamps which are used in miniature searchlights, spotting and signal lamps are rarely made for higher voltage than 50, and usually much lower, even when high-voltage mains are available for supply.

The amount of current required to produce a given amount of light varies considerably in different types of lamps. Apart from carbon or tungsten arcs, mercury vapour, gas discharge and fluorescent lamps, which for one reason or another, are hardly practicable for the purpose under discussion, the "common or garden" glow filament lamp also varies considerably in efficiency. In the early days, of carbon filament lamps, it was considered pretty good to get down to 3 w. per candle-power ; the introduction of metal filaments enabled this to be reduced first to 2 and then to 1 w. per candle-power, and the gas-filled or "half-w." lamp practically doubled this output by enabling the filament to be run at a much higher temperature in a bulb from which the last trace of the "universal destroyer," oxygen, could be entirely and positively excluded.

But in a projection lamp, an even more important factor than actual efficiency in candle-power is the ability to direct it into a tight beam, which makes it essential that the entire light-source must be concentrated into a very small space—as near, in fact, to a mathematical "point" as possible. From this point of view, the arc lamp is still the most efficient of all illuminants for projection, but there are many



Details of lamphouse fittings and other minor components



The complete lamp and mirror assembly in position. The lamp shown is an exciter lamp as used in cinema sound reproducing systems

objections to its use in a small projector.

In the high-voltage mains lamp, the filament must necessarily be of high resistance in order to pass the small amount of current in a lamp of moderate wattage; this means that it must be relatively long and very small in diameter. For the purposes of general illumination this is no practical disadvantage, and if the bulbs were made large enough, and filaments well supported, might even be an advantage. But it introduces some serious difficulties when it becomes necessary to concentrate the filament into a very small cluster, as it is obvious that adjacent loops of filament must on no account be allowed to touch each other, even when high temperature causes them to sag. It also becomes difficult to dissipate the heat away from a concentrated cluster of incandescent metal, with the result that it is generally found necessary to run the filament at a lower temperature than is really desirable to obtain the most efficient illumination, and even so, the life of really high-power focus-filament lamps is usually rather short.

For large lanterns and cinematographs, the diameter of the objective is sufficient to utilise the beam from such lamps fairly effectively, but in a small projector it is found impossible to concentrate the beam small enough to pass clear through the objective without "spilling," and this often results in patchy illumination, apart from waste of light.

In low-voltage lamps, on the other hand, the filament is much thicker and shorter, as the resistance necessary to pass a given wattage is lowered in proportion to voltage and in inverse proportion to amperage; therefore the filament is much more robust and will not only stand up to mechanical shock and vibration, but also to electrical overload, so that it can be run at a higher temperature, and thereby produce more efficient illumination. Motor car headlamps, as everyone knows, are noted for their qualities in both these respects. As the filament is shorter and much more compact, it can be wound into a self-supporting coil, or held by the minimum number of supports, with little risk of sagging, and occupying a very small space. It is possible to overrun such lamps up to at least 25 per cent. excess voltage, without shortening their life to a very serious extent, and under these circumstances, a 36-w. bulb, rated at 12 v., but run at 15 v., will produce *at least* as efficient screen illumination as any normal 100-w. focus-filament lamp run direct on 220-v. mains (110-v. lamps, by the way, are somewhat more efficient than the latter).

The lower cost and reduced size of the low-voltage lamp is another important practical asset, and an incidental factor in the reliability of the projector. One often hears of the hold-up of a lecture through the failure of the lamp, and it is reasonable to suppose that there is more likelihood of having a spare available, when the lamp bulb is cheap, and small enough to be stowed without taking up too much of the valuable space of the lecturer's or projectionist's impedimenta.

A Universal Miniature Projector

A large number of readers have expressed interest in these articles, and have asked for constructional details of the larger "universal" projector, which takes, in addition to single-frame filmstrips, double-frame strip and miniature glass slides. In accordance with their wishes, a full description of this projector will be published as soon as the present design has been dealt with.

(*To be continued*)

Calling Mr. J. J. Ward

We have received a letter from Messrs. E. W. Cowell, of Watford, who say that a Mr. J. J. Ward, presumably of Sheffield, recently sent them a request for a catalogue of drilling-machines but omitted to enclose his address. Messrs. Cowell would be glad if Mr. Ward will forward them his address so that they can reply to his request.

TEST REPORTS

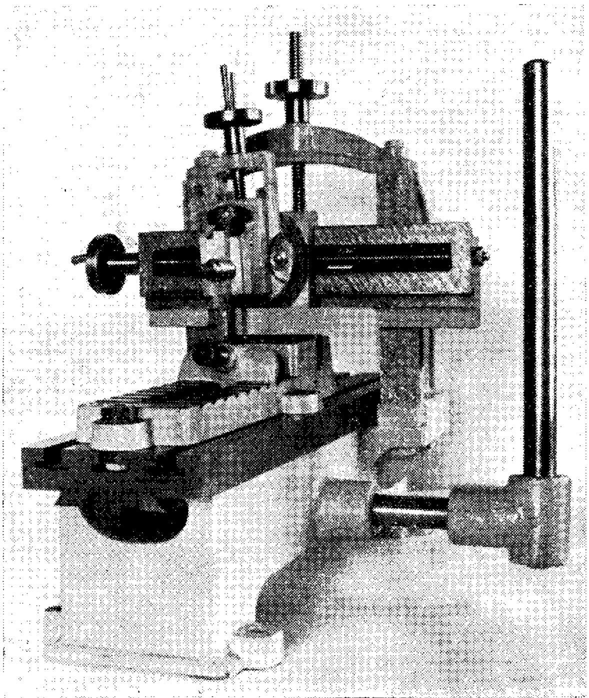
Some expert comments upon items submitted by the trade

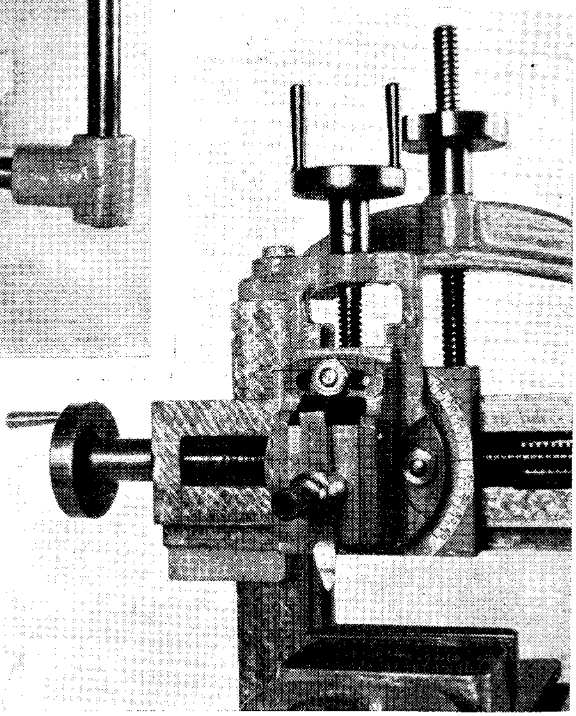
The Alton Hand Bench Planing Machine

THIS tool was submitted by Messrs. P. C. Payne & Son of Back Lane, Keynsham, Somerset.

The leading dimensions are :—

Length of stroke, 14 in.
Maximum height under tool, $3\frac{1}{2}$ in.
Width between uprights, $4\frac{1}{2}$ in.
Table 15 in. × 4 in.
Tools $\frac{5}{16}$ in. square.
Weight 45 lb.





Figs. 1 *and* 2

The general design of the machine is on orthodox lines, and the castings used are well-proportioned and of substantial construction.

Table and Bed Slides

The most important requirement in a planing machine is, perhaps, that both the bed slides and the table itself should be well-designed and accurately fitted, in order not only to produce accurate work, but also to ensure good wear-resisting qualities in the machine.

The bed slides were tested with a standard straight-edge, 12 in. in length, in the manner shown in Fig. 3, and shims were introduced at points where contact was not established in order to obtain an estimate of the value of any inaccuracy present.

This test showed that the near-side bed shear was 2-thousandths of an inch concave towards the centre of its length, and the off-side shear was likewise $1\frac{1}{2}$-thousandths of an inch concave.

The flat bearing surfaces on the underside of the table were also found to be concave ; the near-side side surface was 2-thousandths and the off-side surface $1\frac{1}{2}$-thousandths of an inch concave when measured over a length of 12 in. This was confirmed by resting the table on a surface plate, as shown in Fig. 4, and then moving the test indicator along the slide bearing surfaces. The upper surface of the table, when tested as in Fig. 3,

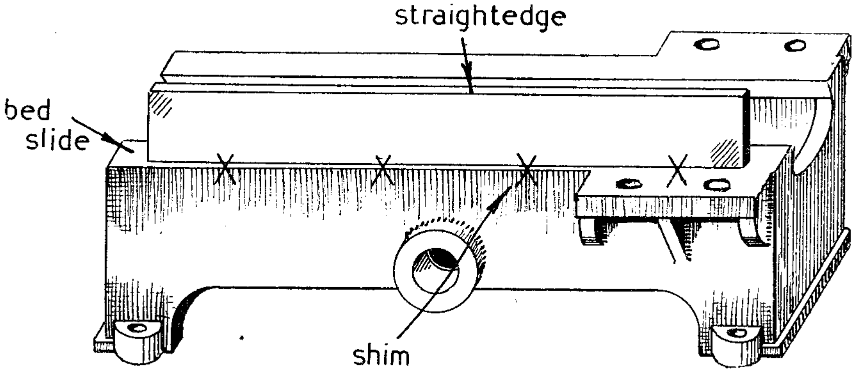


Fig. 3. *Testing the bed slide with a straight-edge*

proved to be convex to the extent of 3-thousands of an inch in 12 in.; this was confirmed with the test indicator, by rocking the table while resting on its upper surface on the surface plate, as in Fig. 4. A reading also taken across the table showed a concavity of 1-thousandth of an inch.

The table, with its rack and gib removed, was next placed in position on the bed, and it was then found that, when tested with a feeler gauge, the table rocked on two diagonally opposite corners to the extent of 3-thousandths of an inch; this precluded a test being made to determine the accuracy of the table when moving on its slides.

The four $\frac{3}{16}$-in. Whitworth screws holding the angular gib-piece to the underside of the table were found to be loose, and this was necessary to enable the slide to be moved in the normal manner. Loose screws in this situation afford no proper fixation or end-location of the gib-piece.

The base casting carrying the bed slides would be stiffened if it were furnished with cross-webs.

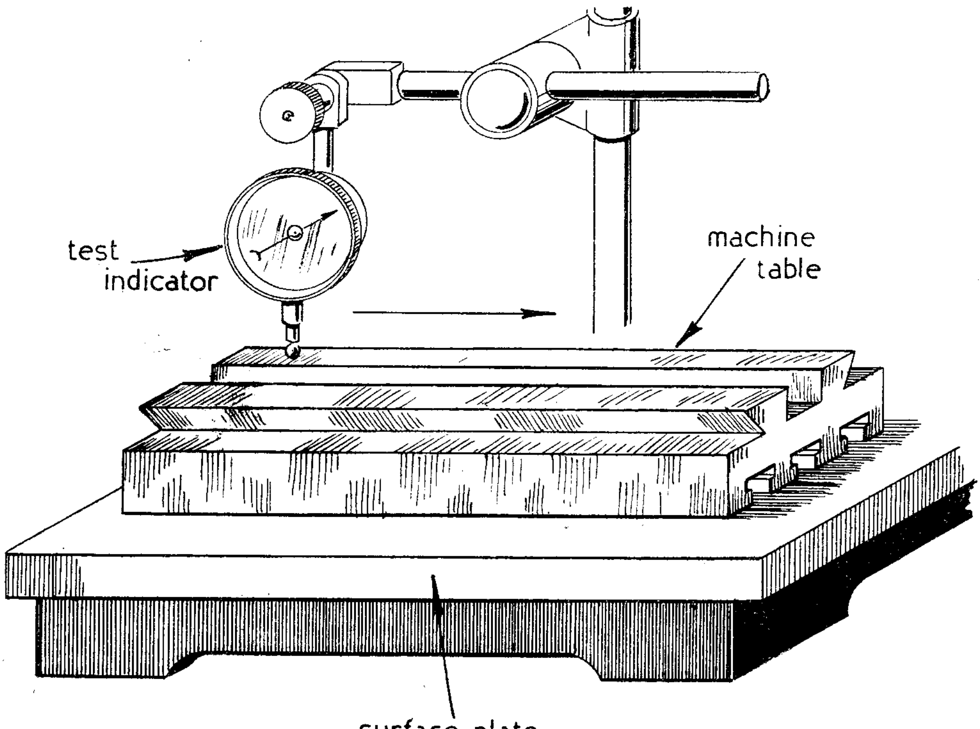


Fig. 4. *Testing the table slides*

The Rack Gear

The rack pinion has well-machined teeth, but the rack itself consists of an iron casting with rather rough, unmachined teeth. The rack is attached to a machined surface on the underside of the table by means of four $\frac{3}{16}$-in. Whitworth screws; these screws were found to be loose, and an additional fixing to take the end-thrust to which the rack is subjected might well be considered.

The depth of engagement of the rack teeth in the pinion was set by interposing two paper shims between the rack and its seating. The rack-pinion shaft is fitted in bearings formed in the bed casting, and the near-side bearing was found to have 7-thousandths of an inch of radial play.

The Tool Feed Mechanism

The cross-rail, which slides on the two uprights, is provided with clamping-plates and an adjustable gib-strip. The cross-slide base, formed integrally with the rail, carries the cross-slide, and to the latter is secured the tool-slide with its clapper-box and clapper for holding the planing tool.

The alignment of the cross-slide in relation to the bed surface was tested as illustrated in Fig. 5. This showed that the surface of the near-side bed shear was 3-thousandths of an inch higher than the corresponding off-side surface.

Owing to the table rock present, the alignment of the cross-slide relative to the table surface could not be usefully tested in this way. The cross-slide has a well-fitted gib-piece which provides the correct adjustment of the slide when the retaining screws are fully tightened to seat the gib firmly in place.

The tool-slide, which swivels to 45 deg. in either direction on its graduated base, is fitted with a gib-piece for taking up wear. The clapper-box is fitted with a tapered hinge-pin of rather small diameter, but there is some shake at this joint, although the pin is seated up to its head and no further adjustment can therefore be made. The clapper-box can be set-over to give relief to the tool when planing angular surfaces.

The Machine Vice

This accessory, which is supplied at an extra cost, is of the quick-setting type and will hold material up to $4\frac{3}{8}$ in. in width. Unhardened-steel pad-pieces are fitted to the jaws. The fixed jaw stands at right-angles to the work face, but the movable jaw, when tightened, gapes at its upper surface for 3-thousandths of an inch.

With the vice resting on the surface-plate, and with the test indicator applied to the work face, the error of parallelism was found to be nowhere greater than 1-thousandth of an inch.

It was noted that the two T-bolts, used to secure the vice to the machine table, were too short; one projected for only 5/32 in. to engage a nut $\frac{5}{16}$ in. deep.

The machine, as a whole, is effectively painted in an art shade corresponding to what might be termed duck-egg blue. It is, however, advisable to paint even the unexposed unmachined surfaces of iron castings, for this will stop the scale and sand entering the working parts of the machine.

Operating The Machine

Two full turns of the handle are required to move the table from end to end, and this is not easily performed with one hand when using the straight lever provided; moreover, as no stops are fitted, the rack becomes disengaged from its pinion when this range of travel is exceeded.

The machine could be more easily operated if a self-acting feed were fitted to the cross-slide; this would be neither a difficult nor an expensive matter.

As both the tool-slide and cross-slide feed screws do not turn in the usual direction of rotation, a worker, accustomed to the normal direction of feed, might have difficulty in operating the machine. The small feed handles seem to provide rather too little leverage for convenient working.

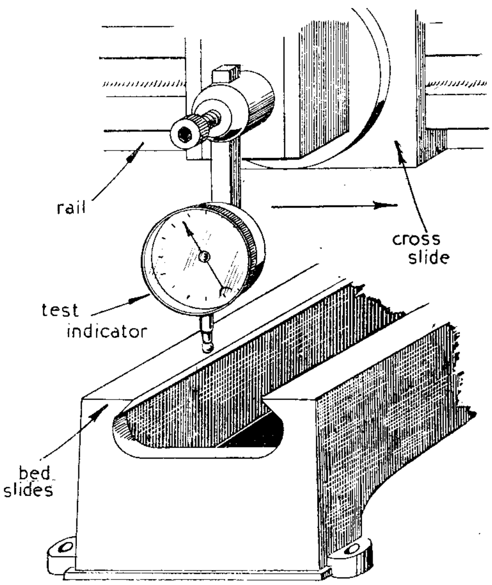


Fig. 5. Method of testing the alignment of the cross slide with the bed

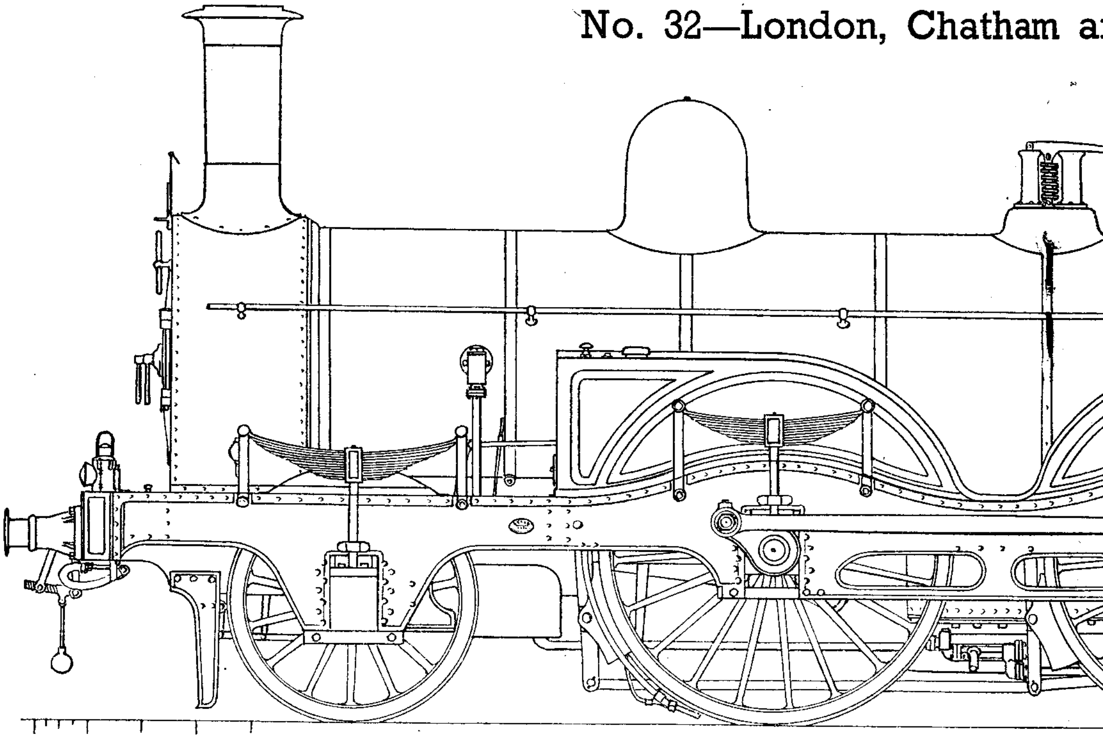
Nowadays, it seems to be regarded as essential that the feed screws of machine tools should be furnished with graduated indexes. By reason of the rock in the table, previously referred to, it was considered hardly profitable or fair to submit the machine to a working test.

Conclusion

Although some departures from a reasonable standard of accuracy have been noted, and the fitting of the slide gib-pieces and the rack have, perhaps, called for particular comment, nevertheless, the machine might well be developed as a useful piece of equipment for those desiring a planer, capable of machining light work too long to be accommodated in a small shaping machine.

LOCOMOTIVES WORTH MODE

No. 32—London, Chatham a

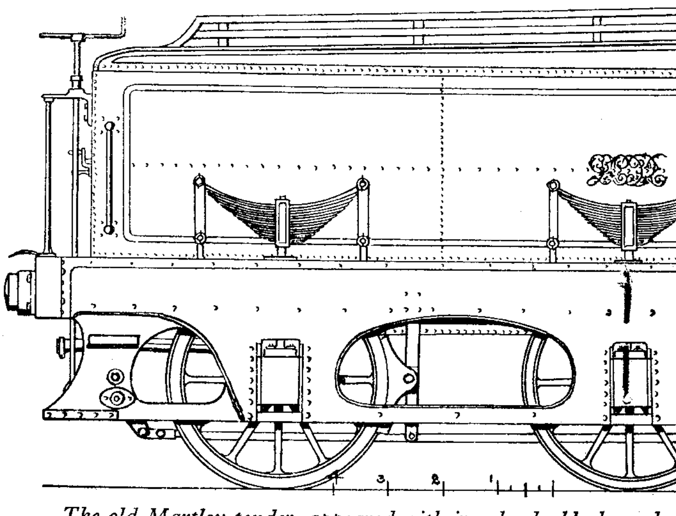


"No. 54 was a good engine, both for steaming, pulling and running." This was how Driver F. Lainson described elevation shows what a beautiful locomotive she was. Note the side plates to protect her link motion

"THIS locomotive was rebuilt in the year so-and-so." How often one has read these words! What varying emotions this familiar statement has aroused in those interested in that particular engine! The C.M.E.—"She'll do the work twice as well now—and burn only half as much coal!" The driver, "Wonder what will happen now? The last time they gave the old engine a heavy rebuild it proved so heavy that she collapsed on the road first time out!" The modern enthusiast, "Gosh! doesn't she look grand with that short chimney and new style of painting!" The old die-hard, "Completely ruined her appearance. Wish I could see her still as she was in the dear old days!"

Well, it takes all sorts to make a locomotive world, and it does broaden one's outlook to listen to other men's opinions (or does it, on the other hand, rather tend to confirm personal likes and dislikes?).

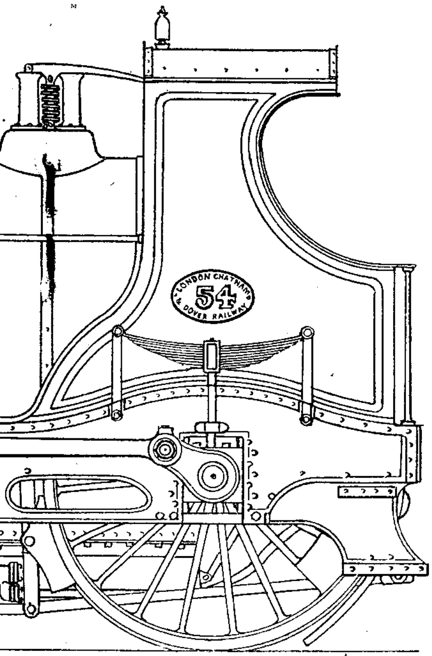
Be that as it may, new brooms—and designers—nearly always sweep clean. Not a shadow of doubt about that, for



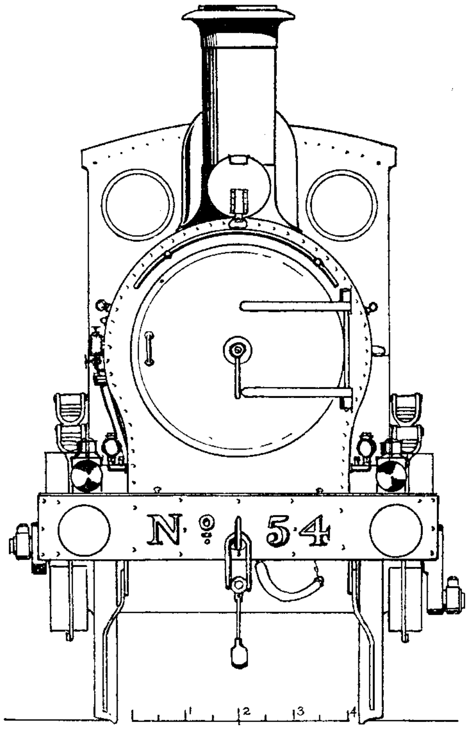
The old Martley tender appeared with iron brake-blocks and a

ODELLING by F. C. Hambleton

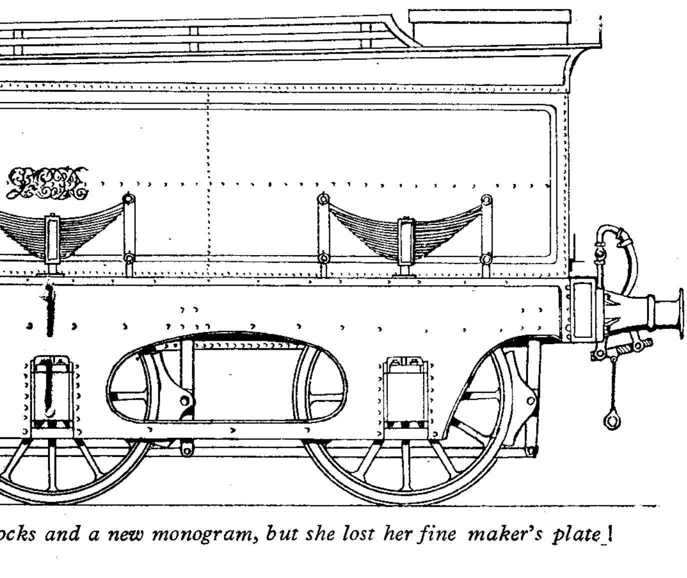
ham and Dover Railway—No. 54



*n described her to me. A glance at her side
ink motion from grit and dirt*



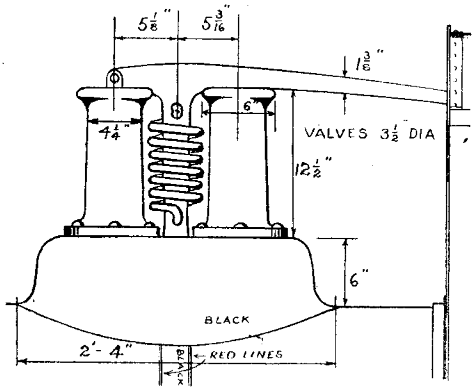
No. 54 ready for the boat train to Dover



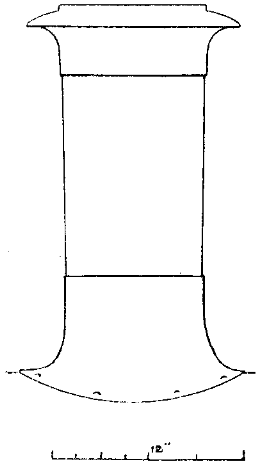
ocks and a new monogram, but she lost her fine maker's plate!

example, at Longhedge Works. William Kirtley swept away most of the picturesque from the old Martley engines. The green paint, the nice old brass nameplates, all the shiny frills and twiddles, ornamental domes and the like, all steadily vanished from the Chatham engines. And when, in 1892, *Asia* emerged from the works at Battersea as plain No. 54, her new boiler and cab painted a sober black, and her general outline rather a severe one, how was she received, I wonder, by her old driver and fireman, W. Stark and R. Kebble, and by all those familiar with the earlier fashions of the L.C.D.R.? As I was one of those who gazed at plain No. 54 in the Chatham days, perhaps I may be permitted to record my own reactions to the sight of the re-created beauty.

Good locomodeller, in spite of all the attractive things of an earlier regime, nobody, I imagine, could look at a Kirtley chimney, nor the elegant safety-valve, the slightly tapered dome, the cab, or the gilt monogram on the tender-side with-

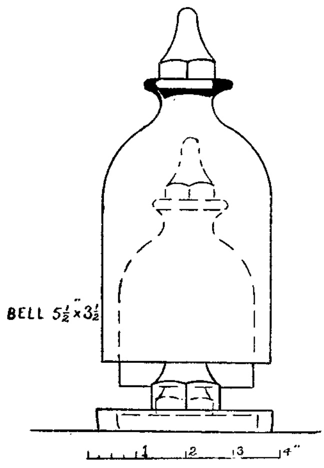


Kirtley's version of the Ramsbottom valve—a pleasing design, too



This Kirtley chimney, with its sweet, clean curves, was indeed a design that delighted the eye. One might say it had "personality'

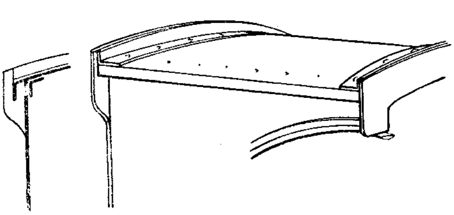
out feelings of delight. True, all these details—and many others likewise—were to become the new standards, and there is much that may be bad in mass production; but when the standards are beautiful in themselves, well, then, there is much that is very satisfying to the eye in constantly viewing these splendid things. Truth to tell, No. 54 was still a wonderful-looking engine, and two models of her, in her earlier and later days, placed end to end, would surely puzzle the locomotive aesthete as to which was the finer (hint to modellers!). At any rate, let us suppose we are examining model No. 2. Notice the unusual roof contruction?—and the red spring and polished brass columns of the



The Kirtley "soprano and tenor" looked well in polished brass. The tenor stood on the left, or fireman's side

safety-valve? How well, too, the brass number-plate (with its black background) and the brass band covering the front tube-plate angle-iron look! What a rich black paint, with its shining varnish finish (just like the original!); she is *really* a black engine, isn't she? Black everywhere, except the front of the buffer beam (vermilion with black edging) and the polished side-rods. The lining round cab-side and driving splasher is a broad grey one, edged outside with a fine red, and inside with a fine yellow line. The same band is to be found on the tender-side. A fine red line is run round the edge of the frames an inch inwards, likewise round the guard iron, end of wooden buffer beam, axle ends and outside-cranks, spring-buckles and tender coping; gilt monogram on tender side, and gilt numerals shaded black on front face of buffer beams.

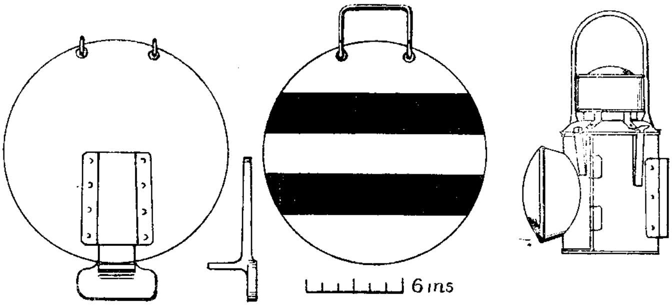
Kirtley designed a most excellent type of headlamp which was painted red—a very unusual colour at this period. The lamps resembled the Stroudley pattern, inasmuch as they had a 6-in. lens (a very large size, this), and a revolving inner body to give white, red or blue (or should it be green?—although on most railways, the glass



No. 54 had a cab roof of rather unusua construction

was really electric blue). Old No. 54, like all L.C.D.R. engines when on express trains, carried by day, one of these lamps over each buffer, and a white headboard at the base of her

chimney. This seems to have been the universal "fast train" code, but on the back of the white board two black bars were painted. On which routes were these carried? Does any good locomodeller happen to have the L.C.D. Code *prior* to 1899? If so, I should love to see it! So I should your model of our graceful, lively No. 54 when you have finished it!



L.C.D.R. headboard and lamp. The latter was one of the best designed and nicest looking of head-lamps

Some Useful Dimensions:

New boiler, length, 10 ft. 10 in.
New boiler, diameter, 4 ft. 3 in.
Centre above rails, 6 ft. 10½ in.
Firebox, length, 5 ft. 6 in.
Cylinders, 17 in. × 24 in.
Wheels, 6 ft. 6 in. and 4 ft. 6 in.
Wheelbase, leading, 7 ft. 9 in.
" trailing, 8 ft. 3 in.
Height of cab, 7 ft. 0 in.
Dome cover, height, 2 ft. 6 in.
" " diameter, 2 ft. 3 in.
Chimney above rails, 13 ft. 4 in.
Footplate above rails, 4 ft. 3 in.
Tender wheels, diameter, 4 ft. 0 in.
Wheelbase, 6 ft. 6 in. and 6 ft. 6 in.
Overhangs, 4 ft. 0 in. and 3 ft. 6 in.

A Foster Compound to the Rescue

Mr. A. Wedgewood, of Blackpool, who has been for some months in hospital, and is still bed-ridden in a very helpless state, has nevertheless been able to send us a long and interesting letter. He says that he has written it after "wading through, with great enjoyment, many back issues of THE MODEL ENGINEER." He was interested in our recent account of a steam roller being adapted for printing the *Middlesborough Evening Gazette*, and gives the following account of a somewhat similar incident:

"One Monday morning, after a terrific frost over the weekend, our telephone rang to let us know that a mill, which ground up pottery manufacturers' materials, could not work at all, and could we provide an engine to get it going again? We got into the car and went to investigate; we found that the firm's engineman had walked into the engine-house early that morning and could see only half the flywheel of his faithful old steam engine. Being scared, he hurried away to find a witness, who proved to be the boiler-man; he, too, could see only half the flywheel, but the other half was down on the floor.

The surveying engineer gave the verdict that the flywheel had never before been at such a low temperature; it had burst during the frost, and the rebound of the upper part of the wheel when suddenly freed had caused it to topple over.

For this job, I chose a light Foster compound and arranged a belt-drive off its flywheel, through holes knocked into the engine-house wall. The shafting ran close to the wall and would not allow the use of a wheel larger than the Foster flywheel. Although, with great care, I could get all the mill plant running with this 1-to-1 arrangement, the belt kept jumping off each time a grinding pan or an Absing cylinder was stopped for refilling. When these were restarted, the extra load slowed down the Foster, and the rise in steamchest pressure caused her to fight against the load; five times out of seven, the belt failed to hold such a high torque of the flywheel, which would suddenly spin, and off came the belt!

After half a day of these capers, I ended up by having more masonry removed and turning the Foster round so as to bring the rear wheels up to the engine-house wall. I then set the engine up on timber packings, with the rear road wheels clear of the ground, and drove off one of them with the differential locked. After that, there was no trouble in keeping the whole mill going, due to the reduction of gears providing a more suitable ratio for the job."

"Caliban"—An Animated Tea-Bottle

by "L.B.S.C."

IF there is one thing more than another, beloved by that genial and ingenious architect-engineer of the Falls Grove Railway, Mr. Edward Adams, it is a spot of experimenting "off the beaten track," in a manner of speaking. Not in the actual method of construction, I hasten to add; all his handiwork is thoroughly sound engineering, but it is in his ingenious ideas, and his also very ingenious application of them, that the attraction lies. I have just received some photographs and drawings of his latest creation, an 0-6-0 tank engine "like nothing on earth" as the shoe-polish advertisements say, excepting perhaps a mine engine; though that wouldn't have a fiery snout! Our worthy friend says he wanted to try out a few brainwaves, and built something a bit out of the common. He didn't deliberately set out to build a freak locomotive; she just grew up a wee bit out of the orthodox, and so he called her *Caliban*. Those who are familiar with *The Tempest* may recollect that Caliban is described as a "savage, deformed slave." The steam edition is quite a willing slave; and as for the deformed part of it, some say "handsome is as handsome does." Even an ugly duckling has its uses! Anyway, here is a brief description of the animated tea-bottle, and I hope that followers of these notes will find it as interesting as your humble servant did.

The culprit himself

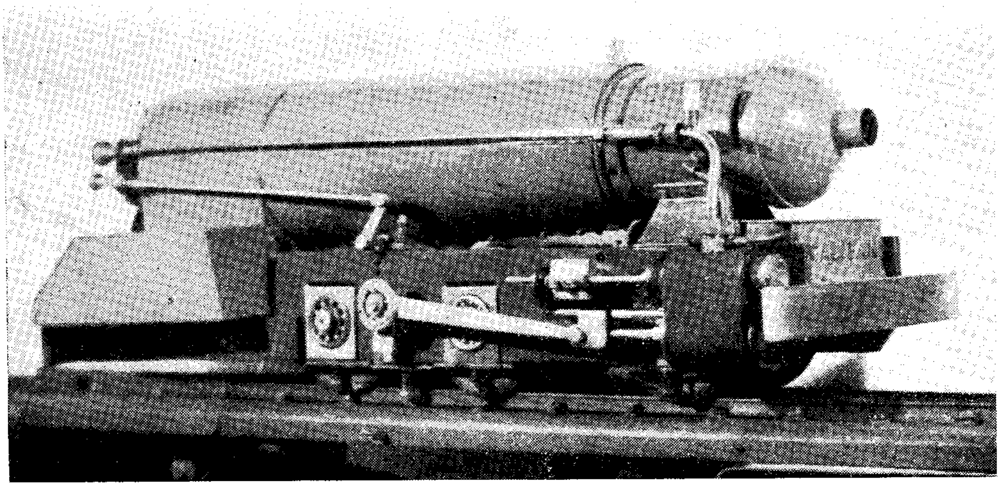
Frames and Running-gear

Our friend wanted to give his vee-tread wheels a thorough test for adhesion, so the frames and other parts were made of heavy-section metal, to increase the weight, especially at the front end, to even out the distribution. Even now, the amount of overhang at the firebox end brings the centre of gravity behind the middle pair of wheels; Mr. Adams says he will probably add more weight at the front end. The actual thickness of the frames is $\frac{1}{4}$ in., and the axles are no less than $1\frac{1}{2}$ ln. diameter (on $2\frac{1}{2}$-in. gauge!) so it is pretty safe to prophesy that the engine will never be towed home with a broken axle. All the journals run in ball bearings, housed in sprung axleboxes, clearly shown in the pictures. There is no buffer-beam in front, but a spring-mounted bumper of automobile pattern.

The wheels are not flanged, but have grooves turned in them, like those in a vee-groove pulley. This kind of tread, applied to one pair of wheels on Mr. Adams's 4-8-2, doubled the tractive effort, so this time he "went the whole hog," grooved the lot, and coupled them by cycle-chains and sprockets between the frames, *a la* the Southern "Leader" class engine, and old Geordie's Killingworth effort.

"The Works"

There is a single cylinder located outside the frame, on the right-hand side. It is 1-in. bore and $1\frac{3}{8}$ in. stroke, with a $\frac{5}{8}$ in. diameter inside-admission piston valve. This drives a layshaft between the second and third pairs of wheels, the shaft being set about $\frac{1}{4}$ in. lower than the axle centres. On this shaft are two bronze friction-discs, the edges of which are turned to fit the vee-grooves in the second and third pairs of wheels. The reduction is approximately 3 to 1. The discs do not permanently engage with the wheels; by means of a simple system of levers, springs and rods, the discs can be put in or out of engagement by raising or lowering the shaft. The engine can thus "freewheel" for the

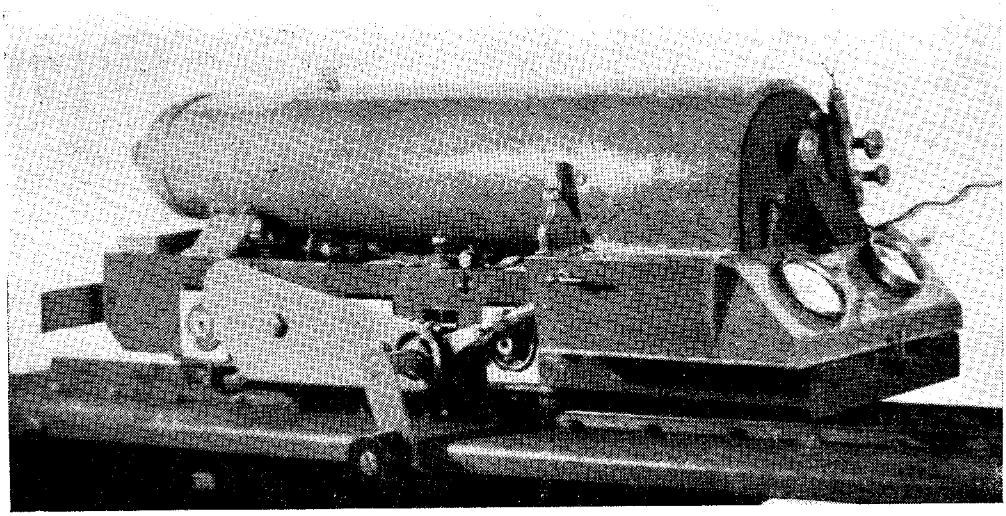


The animated tea-bottle

purpose of warming up, filling the boiler, blowing up the fire, or any other purpose. The shaft extends beyond the frame, and the extension carries the pump eccentric, also a starting-handle, with slip motion, which can be attached for bench running. The shaft also carries a heavy cast-iron flywheel, turned from a weight which once belonged to the domestic scales ; this is between the frames, and helps to ensure steady running, and no sticking on dead centres.

The valve-gear is a form of loose-eccentric gear, and two kinds of eccentrics have been tried, both readily interchangeable. The first is the usual type, but is arranged to give a variable throw. The boss is very large, and instead of being mounted direct on the shaft, it is mounted on a smaller eccentric, which in turn fits the shaft. The variation in throw is obtained by shifting the larger eccentric around on the smaller one, and locking it in the desired position by a set-screw ; the two eecentrics then operate as one, in the usual way. The second arrangement is a variation of the well-known cam action, the cam being triangular with rounded corners. This gives a much quicker opening and closing of the ports, but, strange to say, neither valve drive seems to have any material advantage over the other. The shaft or spindle on which the eccentrics are mounted, is entirely separate, and driven by a chain and sprockets outside the frame, in a manner somewhat similar to the garden lawn-mower. Did I hear a murmur in the breeze which sounded like " spam can " ?

The eccentric-shaft also carries a worm, for

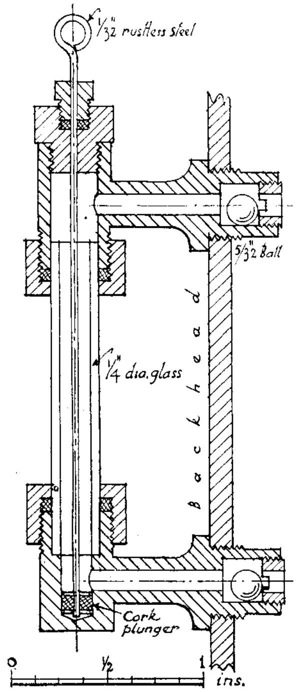


This is where you wind it up

operating a worm-wheel on the spindle of the mechanical lubricator, the reduction being 36 to 1. As this shaft reverses rotation with the direction of movement of the engine, an oil pump of the oscillating-cylinder type cannot be used ; the pump is of the usual pattern, with suction and delivery valves, which are of the ball type, and loaded by light springs. The ram is $\frac{1}{8}$ in. diameter, with $\frac{1}{4}$ in. stroke, and is operated by a slide crank. The complete unit can be removed from the tank by undoing one union and a nut, and the hole in the tank bottom comes in handy for draining out the oil and washing out the tank.

Boiler and Fittings

Mr. Adams says he wasn't risking anything as far as the boiler was concerned, so that part is "genuine Curly" ; it is an adaptation of one of



Water gauge and cleaning device

my wide-firebox boilers, with a grate $3\frac{1}{4}$ in. by 2 in. The barrel contains three $\frac{3}{4}$-in. superheater flues and ten $\frac{3}{8}$-in. tubes. There are two or three small alterations in detail. The firehole is circular and sloped ; the shovel is semicircular in section, to suit the firehole, and the bottom of the coal-bunker is also semicircular to suit the shovel. It is also provided with holes to let the dust out. The shovel has a fancy handle, shown in the photographs, shaped to fit the fireman's fingers, so that it cannot slip and cause him to drop the lot. The ashpan is of the usual type, fitted below the grate, and there are no pipes, rods, axles or other obstructions below it, to prevent it being easily dumped.

Pressure is relieved by a spring-loaded ball safety-valve of the usual pattern, and this is set right up at the front end. The backhead looks rather bare, the only fittings adorning it being the water-gauge, blower-valve, and a connection for the pressure gauge. The latter is an old oil pressure-gauge off a motorcar, and is set in a sort of dashboard which takes the place of the usual footplate. On the other side is another "clock," as enginemen usually call the gauges, which shows the actual drawbar pull. The principle on which this works is the same as a spring balance ; an ordinary coil spring in tension, attached to drawbar and frame. A crank worked from the drawbar turns a vertical rod working in a tube soldered in the tank, and this in turn operates the indicator hand. The dial was easily calibrated by applying a spring balance to the coupling. Mr. Adams says it is very interesting to compare fluctuations in the drawbar pull, with variations in the steam pressure.

The water-gauge is a real Adams gadget. It doesn't possess a blowdown valve, but incorporates a positive glass cleaner. The glass is $\frac{1}{4}$ in. diameter and inside it is a 1/32-in. rustless steel wire with a cork piston attached to the end. The wire passes through an ordinary gland in the top fitting. Instead of blowing the glass down, the driver pulls up the wire two or three times, and the cork piston does the rest. This gauge also embodies two automatic ball valves for shutting off steam and water in the event of a burst glass. The illustration shows the whole lot very clearly. Personally, I would have fitted a blowdown valve as well, putting it vertically at the bottom of the recess which is the normal resting place for the cleaning piston. Then, if the piston is pulled right up above the top opening, the gauge could be drained out. The balls would seat as soon as the blowdown was opened ; and the water, plus any sediment in the glass, could be expelled by pushing down the piston. Maybe the little recess might become choked with "muck" if the feed-water were chalky, or otherwise "dirty," as the enginemen say ; a simple screw plug at the bottom would get over that trouble.

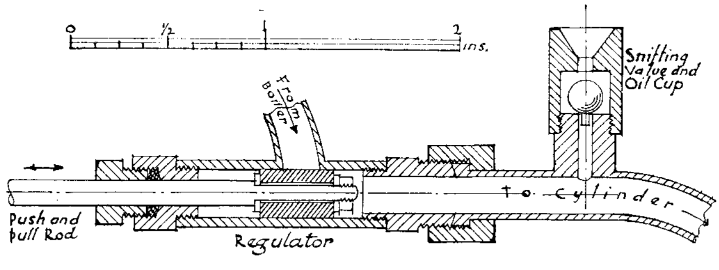
The regulator, shown in one of the illustrations, is a $\frac{1}{4}$-in. diameter piston-valve, operated by a rod passing through a gland, and controlled by a handwheel operating a coarse thread at the footplate end. This is, in effect, a variation of what our cousins over the big pond call a front-end throttle. Being located between the hot header of the superheater and the cylinders, the elements are always full of steam, which reduces the tendency to burn out, when standing with the blower full on. The snifting-valve is placed between regulator valve and cylinder, and serves also as an auxiliary oil-cup, to give the engine a "dope" before starting from all-cold. Our friend says he set the piston-valve by aid of the snifting-valve. There is a "tell-tale" screw in each cylinder cover ; these were removed, and our friend applied lung-pressure to the steamchest by blowing down the snifting-valve, adjusting the piston-valve until the human steam blew out of the screw-holes on each dead centre. Real Adams's trick, that !

The boiler is supplied with water by an ordinary eccentric-driven pump with a diagonal

barrel. The eccentric is fixed on the end of the jackshaft, and the pump itself attached to the water-tank. This cuts the length of pipes to the bare minimum, so reducing pipe friction; the delivery clack is just above the pump, and the by-pass cock inside the tank, operated by an extension handle coming through the side of same. The pump is $\frac{1}{4}$ in. bore and $\frac{1}{2}$ in. stroke. The tank itself is of an unusual shape, since it is not side, saddle, pannier or well, but L-shaped in plan, and has a box attached to the right-hand side, to form the coal-bunker; see illustration of chassis. The tank cover is made from fine gauze, which not only keeps out dirt, etc., but allows the driver to see what comes out of the by-pass cock. Mr. Adams's "patent" emptying plug is also fitted, also a gauze strainer or "strum" on the feed-pipe to the pump. There is no hand-pump provided; as the engine can "freewheel," it can be used as a donkey-pump to fill the boiler when the locomotive is standing.

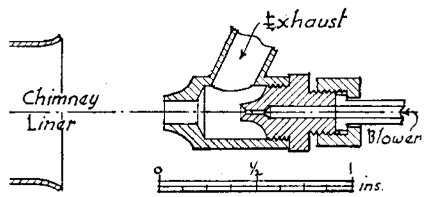
Smokebox

The smokebox is certainly a departure from current practice, and looks like a little vertical boiler that has "fallen over." The position of the chimney would certainly be fatal on a full-sized job; but as our friend truly remarks, there is a vast difference between six and 60 miles per hour, and quotes one of my own pet assertions that "Nature cannot be scaled." He wanted to see what the effect would be if the products of combustion, and the exhaust, went straight out instead of having to turn at right-angles, as it does with the chimney on top of the smokebox, in the usual place. He says it seems to have panned out all right, so far; there is no appreciable retardation, and no apparent blowback, when the engine is running, and there is an added advantage that any drops of oil which are thrown out of the exhaust do not bespatter the driver.

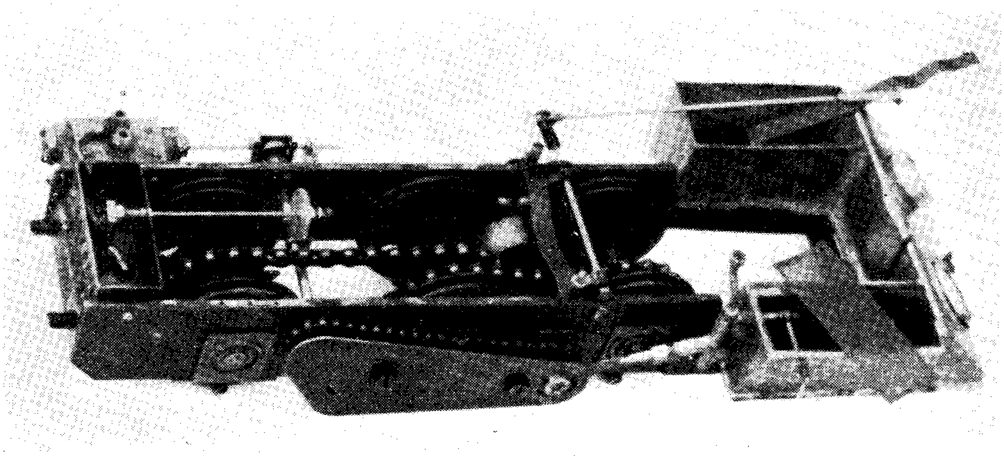


Left—Piston-type regulator valve

Below—Combined blast and blower nozzles



The whole front of the smokebox is easily removable, fitting like the lid of a cocoa-tin, rendering it easy to sweep tubes and clean out. The steam and exhaust-pipe unions are outside the smokebox. The blast nozzle is, of course, horizontal; and it is combined with the blower



What a box of tricks!

jet in the simple manner shown in the detail illustration.

The whole of the boiler and firebox is covered with asbestos sheeting, $\frac{3}{16}$ in. thick, which gives better protection than the usual $\frac{1}{8}$ in.; the boiler can be handled quite comfortably for some time after getting up steam. The outer cleading-plate is of thin sheet brass. Short 3/32-in. rivets are silver-soldered to the edges at staggered intervals, like little buttons, and these are laced up with a copper wire, to make a neat and sound joint.

How the Engine Runs

Mr. Adams says that he has only had a few preliminary canters with the engine so far, but it seems all right, pulling him easily, and keeping up the steam and water without any trouble. He hopes to have some extended trials, and get some data, when the weather improves (at time of writing, we have had a very wet spell) also see whether the clutch arrangement will operate with a heavy load. It seems to act all right with a single passenger.

Well, there is something a little out of the usual run of things. The "spam can" feature, the chain drive, won't suffer the same disadvantage as in full size, as there isn't enough strain on the chains to stretch them. Ball-bearing axles are tried and proved; my 4-6-2 "Fernanda" has been running 15 years or more with them, and there is no play anywhere, whilst the engine will coast freely around my road to an amazing extent. The only thing I am doubtful about is the arrangement of vee-grooved wheels. The inability of these wheels to run over points and crossings doesn't matter a bean on the Falls Grove line, as there are none to run over; but the "extra adhesion" gained is, in my humble opinion, going to be offset by the disadvantages of extra friction and excessive wear of both wheels and railheads. As we all know, on a circular line, the wheels on the outer rail must of necessity travel farther than those on the inner one. The extra grip provided by the vee-groove naturally applies to the wheels on both sides of the engine. Therefore, it doesn't need a Sherlock Holmes to deduce that it will need more power to enable one side of wheels to slip the necessary amount; and with the grip that the vee-groove affords on the railhead, considerable wear is likely to take place between the rails and the slipping wheels, more so as the slipping must be continuous, as the Falls Grove Railway is a perfect circle, without any straight stretches to "give the engine a rest."

There won't be any question of the power available to "keep the grooved wheels turning," to parody a once-popular song, as a cylinder 1 in. bore by $1\frac{3}{8}$ in. stroke, backed by the specified boiler, and "geared down" in the ratio of 3 to 1, should be able to do practically anything; the effect would be the same as an ordinary three-cylinder job, except that the latter has no dead points, whereas *Caliban* has six (incidentally, also six beats) in each revolution of the driving wheels. Again, with the freedom of running given by the ball-bearings, the slight loss of power at the dead-centre points should be entirely negligible, and the chance of stalling exceedingly remote. Anyway, the whole outfit is an interesting experiment, and we can trust our old friend to exploit it to the full, and let us all know in due course, how the job pans out. I, for one, shall be mighty interested!

Foundation Rings

Curiously enough, just after I had written the notes about converting *Dot* to a Pacific type, and mentioning in them about dispensing with a foundation-ring in a narrow firebox, in order to get a wider grate, some queries came in on the same subject; so here is a brief reply covering the lot. There is nothing against flanging out the bottom edges of a firebox, and brazing it direct to the wrapper, without using a foundation ring, provided that the joint is properly made. I usually specify a direct firebox-to-shell joint in all boilers having a sloping throat-plate, as you will see by taking a look at my boiler drawings. The boiler for *Pamela* will have this type of joint between the front firebox plate and the throat-plate. The boilers specified by our late friend, Bro. "Iron-wire" Alexander, had fireboxes flanged out at the bottom, and soft-soldered to the outer shell. The inner fireboxes were brazed; the metal was very thin, 21-gauge copper for the firebox and 24-gauge for the shell, but then the working pressure never exceeded 30 lb. per square inch, and the firing was by "poison-gas plant."

If it is desired to dispense with the foundation ring on engines of $2\frac{1}{2}$-in. gauge and upwards, a better way would be to leave the firebox sides and ends straight at the bottom, and bend in the lower edges of the wrapper to meet them, putting a few rivets in, to hold the lot whilst brazing. One very effective way of doing away with a solid ring, but obviating any need of flanging or bending the firebox or wrapper sheets, is to fill in the space between firebox and shell with pieces of sheet copper bent to the shape of a U. These are inserted "horns first," and the bottom of the U left flush with the bottom of the wrapper sheet. Put about three rivets through each side, in the case of a $2\frac{1}{2}$-in. gauge boiler, to prevent the U-bars slipping down, and to keep the plates in contact. Then, when you turn the boiler upside-down in the brazing pan, put plenty of wet flux all along the grooves formed by the bottom of the U, and the firebox and wrapper plates; get your blowlamp or blowpipe working overtime, and completely fill the grooves with brazing material. Easy-running strip is best for this job, unless, of course, you have the use of an oxygen blowpipe, with either coal-gas or acetylene, and can fill up with Sifbronze. If properly done, the result will look exactly like a rectangular foundation ring brazed in; will stand any pressure the boiler can carry, and wouldn't spring a leak in a thousand years.

In very small boilers with wide fireboxes, such as a gauge "O" Pacific or 2-6-2, the foundation ring can be dispensed with by the simple wheeze of making the inner box have a sharper taper at the sides than the outer shell. The dimensions of both, at the bottom, should be practically the same, so that the plates meet. This construction gives a water space wider at the top of the firebox than at the bottom; a feature often found in full-sized engines, and helping to make the boiler a free steamer.

" Safety Sense "

by C.P.B.D.

As a chief draughtsman of a jig drawing office, one important aspect of my work is the supervision of the safety factor in the design of equipment. I do my best to instil into my juniors an instinct to search for any dangerous element in the job they are tackling. Superficially, there may appear to be little point in stressing this item, when there are so many other points of design to consider. There is no doubt, however, that a bad machine set-up can create the circumstances in which life and limb may suffer, so I prefer to regard safety as an essential consideration.

Of late, I have seen several home-made machines which rather horrify my " safety sense," and which have impelled me to rush into print with this article. I am not aiming at the professional engineer or at the more experienced model engineer, but at the newcomer to our hobby. As we have no factory inspector of our own and as there are no statistics of accidents in the home workshop, I cannot tell if my fears are warranted or not.

Remember you may not be the victim ; it may be one of your family or a friend, and it is so easy to be wise after the event, so here are a few hints to start you developing a " safety sense " of your own.

There appears to be nothing very dangerous about a sensitive driller, but it has proved itself on all too many occasions to be a worthy ally to the red indian of wild west days. The red indian scalped his victim to provide himself with a scorecard ; the drilling machine does it because someone has been careless. It is that pulley on the drill spindle which causes all the trouble.

Somebody startles you by opening the workshop door suddenly just as you are concentrating on a ticklish job ; you jump ; that shock of hair that will keep falling into your eyes doesn't fall this time, but is wafted between belt and pulley and they are both going round mighty fast !

Secondly, if you are using round leather belting, not the endless variety, and the fastener gives way, you are likely to receive a nasty lash across the face.

Both these troubles can be very easily prevented by a simple sheet metal guard mounted on two small brackets and only representing about half-an-hour's work. The above remarks, of course, apply to all high-speed belting in an exposed position.

Whilst I was serving my time, one of my pals on the next horizontal miller removed his index finger with a 3 in. × $\frac{1}{16}$ in. wide milling saw. The guard was on the machine, but to save time, he had pushed it out of the way—it was the old, old story of familiarity breeding contempt. That incident impressed me more than a host of " Safety First " lectures could ever have done. High-speed milling cutters ; circular saws ; band saws, etc., are lethal weapons and must be adequately fenced or guarded so that in the event of a chance slip, it is not possible to foul the cutter. It is, of course, just as important that the cutter be thoroughly anchored in its seating.

All those 6-in. grinding wheels—stark naked, dashing round at a few thousand r.p.m.—one on each end of the spindle—what a terrible sight ! They must have guards and tool-rests ; the latter fitting as close up to the wheel as possible, not half-a-yard away so that the piece being ground may slip in between the rest and the wheel, causing wheel-breakage.

A proper grinding guard must be of heavier construction than the normal belt-guard, and has to be carefully designed to deflect all the pieces of the wheel in a direction in which they will do no harm, generally down into the chip-tray.

Wheels must be fitted with a paper washer on either side to allow for any discrepancy in the thickness of the wheel. They must be checked over before fitting, to confirm that they are not cracked. And, finally, makers' recommendations regarding maximum speed must be observed. I think the well-known manufacturers will be only too pleased to provide literature to assist you in all these points.

A small Perspex adjustable chip guard can save you endless pieces of swarf in your eyes.

Watch your coat or shirt cuff, roll them up preferably ; they are such admirable things for catching on irregular-shaped work which you may have overlapping either the four-jaw or faceplate.

Last, but by no means least, keep the floor clear of both oil and junk around your machines, so that you do not slip or trip up.

My rather lurid descriptions may give you the impression that I am a pessimist. In actual fact, I am an optimist, because I hope everyone reading this will be able to say quite truthfully that they at least aim at, if not quite achieve, a safe workshop. May I be permitted to end with a well-worn cliche ; " Better be safe than sorry."

A New Club for Wales

We have just heard of the formation of a model engineering club in Fishguard ; it claims to be the only one in North Pembroke. We are very interested to learn of this, and we extend our good wishes for its future success. We understand that three of the members are about to build model cars, but there is a demand for information on locomotives, boats and other model engineering matters ; so we are hoping to hear more of the club's activities in due course.

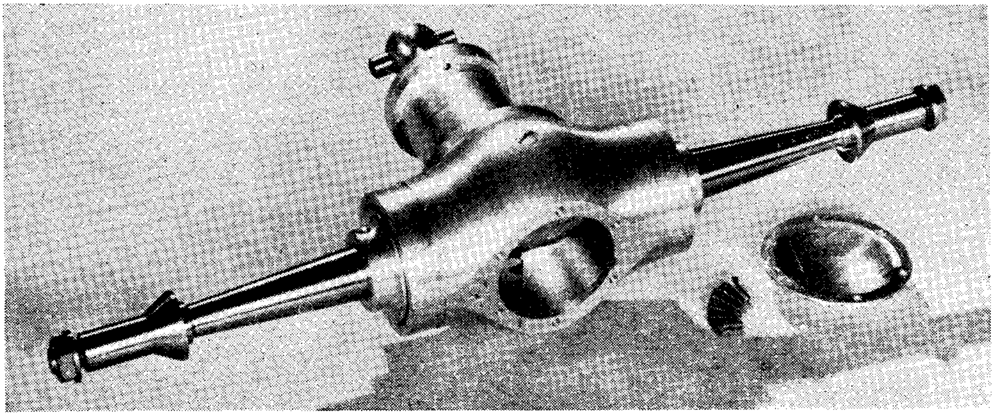
The hon. secretary is Mr. A. Lange, " Mandal," Sladeway, Fishguard, who will gladly furnish any further information required by anyone who may care to join the club.

The Pros and Cons of Miniature Transmission

Spur versus Bevel

by G. W. Arthur-Brand

VOLUMES could be written in an endeavour to substantiate the countless theories put forward by the exponents concerning the most efficient and effective means of transmitting power to the driving wheels of miniature racing cars.



A good example of an efficient bevel-type rear axle by Z.N. Motors, suitable for adaptation to independent suspension

The practical side of the question has received its fair share of attention, too, as witness the large variety of layouts employed, mainly, by the older hands who endeavour to maintain a reasonable scale resemblance.

Anticipating a revival of the true-to-scale model, I would like to discuss the two most popular systems, and I sincerely hope that I will be able to convince you that there is very little effective difference between spur and bevel drive, always provided, of course, that the design is sound and the installation correctly carried out.

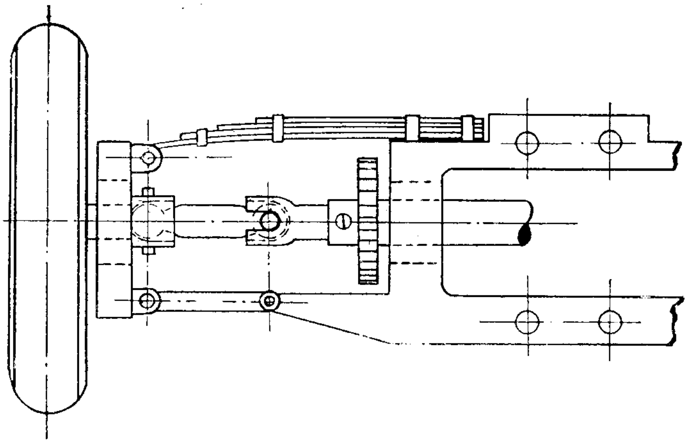
Let us start with spur drive.

An increasing number of " sheer speed " fans are using spurs to drive their models. The usual arrangement is for the motor to be installed in a horizontal position with the mounting lugs secured to a bracket through which the back axle runs in ball-races. Now, what are the obvious indications for and against this system ? We will take them briefly one by one.

First, the distance between axle and cylinder-head is such that some part of the motor inevitably finds its way into the cockpit, thus ruining scale appearance. A scale model must, remember, present a scale effect, even if we have to make do with a single-cylinder two-stroke as motive power, and there are few departments in a well-designed and constructed working scale model more interesting than a nicely laid out cockpit, complete with steering wheel, instrument panel, gear lever, clutch and brake pedals, fire screen and full upholstery. Such luxuries are impossible with the spur-geared model.

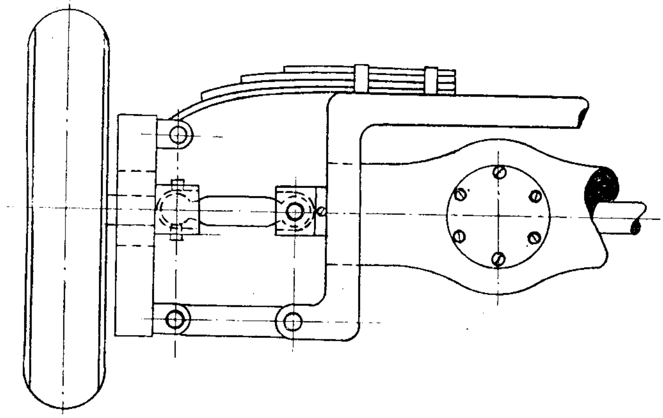
Secondly, that much vexed question, springing. How best to achieve results from springing I do not intend to discuss at this period, but all will agree that, again in order to effect a true scale appearance, and performance, rear suspension is a *must*. Now while I must admit to having heard of rear suspension being incorporated on a spur-driven car by means of radius arms, I most strongly doubt whether, due to torque, any useful purpose could be served, and I am willing to wager that even at quite modest speeds, the effect of cushioning of any description is conspicuous by its absence. Independent suspension could, however, be employed quite effectively in the manner shown, but we are still left, in the case of the more normal layout, with our engine in the cockpit, so independent suspension would be merely a case of love's labour lost ! But let us look at the question from the point of view of the " 500 " specialist, or the individual who may be smitten with the desire to build a scale model of the Auto Union of the pre-war era.

It will easily be seen that, given adequate overall dimensions, this will be by far the most adaptable and generally suitable form of drive. Using the independent system shown with transverse leaf springing and wishbones, a very true-to-type Cooper rear-end could be concocted and radius arms in conjunction with a de Dion tube will greatly enhance the Auto Union appearance. Perhaps the greatest advantage to be gained from this form of suspension, however, is the incorporation of all working parts in one main assembly so that the whole unit may be removed



Left—A front view of an independent rear suspension system for spur-geared cars. This drawing is not to scale and is intended only as a guide to design

Below—Rear view of a suggested method for adapting the Z.N. bevel unit for independent rear suspension. The bottom links in both this and the bevel system are wishbones. (Not to scale)

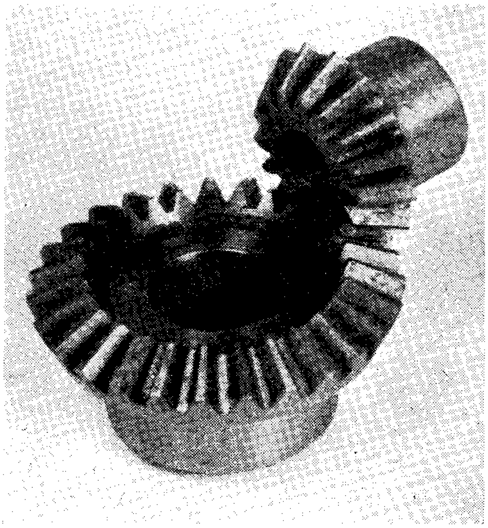


from the car without dismantling. Due to the robust nature of the engine bracket, there will be little chance of distortion due to stresses transmitted on a bumpy surface, and less wear is likely to take place due to complete absence of warping as the result of the action of centrifugal force.

We will now shelve the spurs and probe the bevel question. The obvious advantages? Well, to begin with, a bevel back axle is much nearer "the real thing," as witness the very fine example of a Z.N. unit shown here. Secondly, the engine may be placed in its correct position under the bonnet, with flywheel and clutch assembly driving through a carden shaft in a very realistic fashion. But what of the disadvantages? The usual argument runs that efficiency is bound to be lost in any right-angular drive. Without going to the extent of proving the technical insecurity of such an assumption, suffice it to say that the world speed record for miniatures is held by a bevel-geared car, with the nearest "spur" many m.p.h. behind!

What of springing? Obviously, the bevel box lends itself admirably to the usual semi-elliptic suspension of the older racers; but for independent adaptation, we are faced with a slightly more difficult problem than was the case with the spur unit. There are several solutions, however, and apart from constructing a special gearbox to which the springs and wishbones may be attached directly, the method indicated should give excellent results.

Space does not permit a description of the various suspension systems, but at a later date I intend to go fully into the question in the hope that constructors will be encouraged to produce models which emulate in just one more feature, the subjects they are deemed to represent.



A pair of heavy duty bevels in mesh

Gauges and Gauging Technique

by A. N. Appleby

TO understand this subject thoroughly, a knowledge of the construction and application of gauges is necessary and it is hoped in this article to consolidate such a background, so that as experience grows both in design and manufacture, it will produce thoughts that will inculcate the desire to develop and apply gauges which will create and enhance the production of the finished article.

Much of this information may already be familiar to experienced designers and gaugemakers, yet some of the topics discussed may be novel to them, and to the beginner or apprentice, it will be an advantage to have the information in convenient form.

Gauges

A gauge is a development of measurement whereby a manufacture can be guaranteed to fulfil a desired specification, or to satisfy a required system of limits in order to preserve similarity and effect interchangeability in assembly.

The form, contour or design of gauge, varies with the required performance, and it may take the form of plate, plug, profile, depth, screw, angle, weight, or assembly to mention only a few types, yet the principle is the same as heretofore explained according to the requirements and function.

A good gaugemaker will add interest to his work, and perhaps save a good deal of time, if he will study and grasp the production drawing or assembly to be gauged, including the specification and contract, and take the necessary steps to ensure that all subsidiary requirements are fully carried out, in addition to the actual gauging dimensions.

Inspection

In all well regulated engineering works, a system of inspection is employed, for this department not only approves the sizes of the work presented, but often saves many man-hours by discovering at an early stage obvious mistakes, which if allowed to proceed, would probably permit a gauge to pass a wrong job, or fail to pass a right job.

The inspector will have his own equipment to approve the gauge presented, independent of that used by the toolmaker, and this is a safeguard against fault either in the toolmaker or his equipment.

Inspection is also a wise precaution against the error or errors being repeated at a later stage, for usually if it is found at an early stage it can be remedied.

Again, the inspector's duty is not complete simply by measuring, for it needs little training to do that, but rather his duty should extend to approve the gauge within the policy of the "Company" in order that finish of the gauge is beyond criticism, particularly on the working faces, that hardness can be approved, that clear and legible marking is obtained, that all sharp corners are removed, except where attention is called on the drawing to leave them sharp, and generally to approve the standard that will do credit to its makers.

Equipment

To obtain the ideal combination, the equipment of the toolmaker should be equal to that of the inspector, for it is wise to say, that in the main, the inspector should be employed in approving right work and not to be worried by rejecting the wrong, therefore, toolmakers should be encouraged to co-operate with the inspection and have their equipment periodically checked before approaching final size.

Gauges are usually developed on a gauge drawing and full advantage should be taken of the tolerances quoted on these drawings, for they are intended to assist the toolmaker in his efforts, for it is a well known understanding that "nothing is wholly right," therefore as all manufacturers usually give a tolerance for the product, the gauge should carry about 10 per cent. of that tolerance.

In gauge making, the toolmaker should aim at being within the tolerance with a bias for maximum metal and not waste time in attempting to be on either extreme and run the risk of overrunning it.

Many man-hours are lost by the risk run at being "dead on" or at the safe end of the permitted limit, and it involves much expenditure to correct or adjust, and it delays the gauge being put into service.

Temperature

It would here be necessary to mention the effect of thermal expansion and the serious errors that can be produced unless its effects are perfectly understood.

The cutting of material in the machine sets up heat and before accurate measurements can be taken, a cooling-off process must be applied by either waiting, or plunging the workpiece into a bath of paraffin or other coolant for say 10 minutes before applying any measuring instrument.

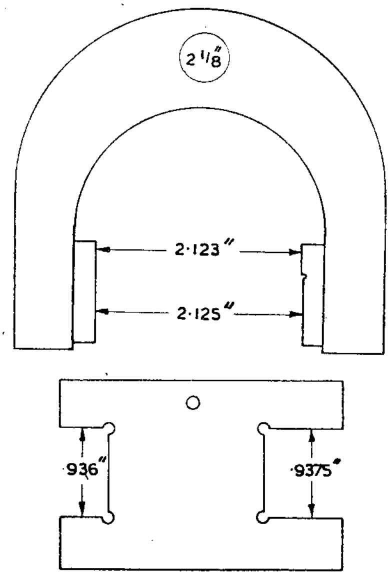
The correct temperature at which a gauge should be measured is 68 deg. F., and all standard reference gauges are approved at this temperature, therefore so long as steel instruments and gauges are checked against steel standards, all will be well, it is only when metals with an opposing coefficient of expansion, such as steel against aluminium, that actual or standard temperatures need to be specially considered.

Hardening

All gauges are usually hardened on their working faces and the selection of steel for gauges

should be so chosen as to prevent, as far as possible, distortion or cracking, and so provision is made for this, and a correcting agency in the form of grinding is instituted.

A test for hardness should be made on the actual working face, if possible, and a close estimate of hardness can be obtained by applying a sharp scriber to the face of the gauge and this is usually sufficient for practical purposes.



Two examples of "go" and "not go" gauges—horse shoe and gap type. Can be used for round or flat objects

If the scriber glides over the surface, it is hard, whilst if the scriber bites into the metal the surface is soft.

Maintenance of Measuring Equipment

Too much attention cannot be given to the measuring equipment which is used in the shops, for metaphorically speaking it fulfils a "hard life" as compared with its counterpart in the inspection department, and it loses its accuracy far more quickly.

A good plan is to have such tools as micrometers, depth gauges, slip gauges, dial indicators and other delicate tools periodically checked by the inspection authority, in order to guard against error in measurement as far as possible.

Manufacture

As mentioned before in this article the choice of steel is a prime factor in gauge making, for gauge makers become accustomed to the performance of recognised steels and much time is often saved thereby, and on the contrary, shifting from one brand to another often interferes with delivery times and plays havoc with recognised routines.

A tool steel with a small carbon content is perhaps the best for all practical purposes and moreover it can be hardened in oil and therefore is not subject to so much cracking as if it were hardened in water.

Some gauges can be made of mild steel where the size of the gauge conflicts with hardening possibilities, but then the gauging faces will have to be locally heated and case-hardened.

A further method of heat treatment can be used in certain instances on mild-steel, for it could be carburised to a depth greater than what is required, then machined and hardened as for carbon steel.

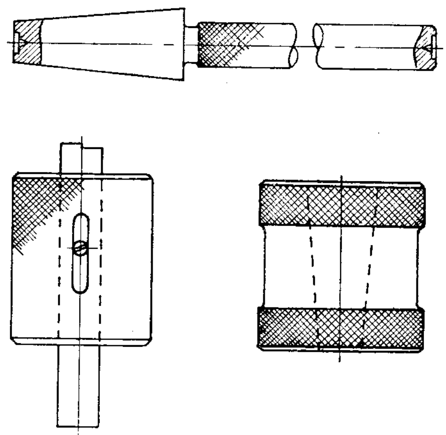
Trouble often occurs with gauges made from plate-steel, for this gives trouble in hardening, and to prevent distortion as far as possible, it may be considered wiser to use a good cast-steel and leave soft, unless there is a considerable friction anticipated on the gauging faces.

Many gauges such as contour gauges are very serviceable left soft, and so gauges need to be considered on their merits and performance; as a hard and fast rule cannot be laid down.

Machining

I do not anticipate any trouble with the preparation of the gauge blanks, yet as machining is required, one or two points are worthy of strict attention.

Take a round gauge for instance, such as a plug gauge, be it straight, taper or screw. The centres should be carefully machined both for size and correct angle and the centres should be protected by counterboring, for if imperfect centres are permitted, the trouble is often delayed for a subsequent operation such as grinding, and above all large centres, affording a large bearing surface, should be avoided if truth, roundness, and concentricity are to be attained.



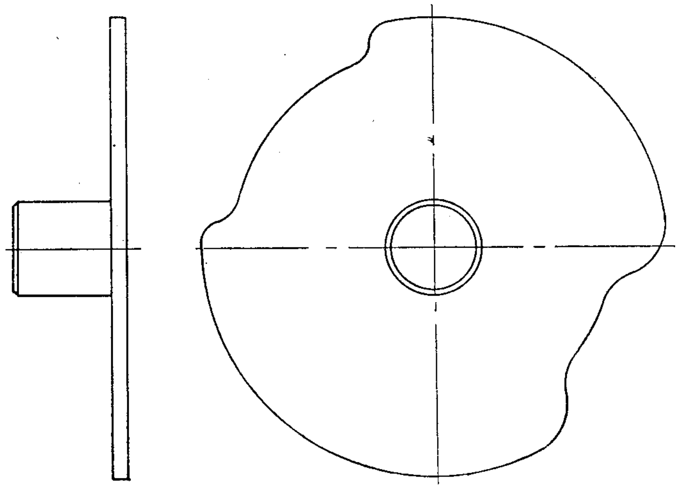
Male and female taper gauge, and a type of depth gauge

After heat treatment, attention should again be focused on the centres and they should be cleaned from all scale and internally ground in case of any distortion.

Due allowances on the internal and external diameters which require subsequent grinding

should be made in the turning operation and as a basis it is suggested 0.008 in. on diameter internal and 0.010 in. to 0.015 in. on diameter for external, and these figures will usually suffice for any distortion in heat treatment.

Ageing, or strain relief by heating should be considered in the sequence of operations if the steel is to remain stable and it is usually done by slow heating at a low temperature for as long as five hours in some cases to 150 deg. C and then allowed to cool slowly.



A type of profile gauge for marking-out a cam or for use on a profile milling machine

Plate Gauges

Let us consider the simplest form of plate gauge, what is known as the horse-shoe or gap gauge ; this is an effort to approve an object for size by passing it between two jaws diametrically opposite.

This type of gauge is often made to accommodate two sizes, one size that will pass the workpiece and the second that will not pass, and these two sizes are present on the same gauges as will be seen from the sketch.

This type of gauge can be designed for round or flat objects, therefore it is essential that the faces of the gauge are flat, square and parallel and that the required size is obtained at points diametrically opposite and opposed in the same plane.

In all gaugemaking the rule, of flat, square and parallel is universal and goes for all gauges including the non-measuring type of gauge for approving a form or contour or profile, for, particularly, in this case, should the edges stand at 90 deg. to the face on which it rests.

This flatness, squareness, and parallelism is best produced on the grinding machine and provided that finish is well considered and thermal temperature is given close attention, gauges are best when coming straight from the machine.

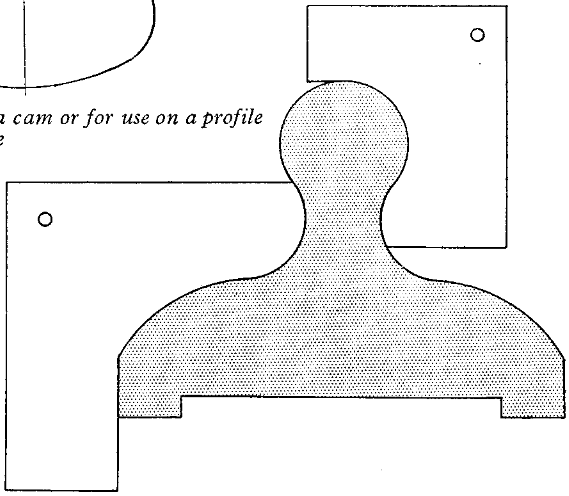
In order to combat the rise in temperature when grinding, a roughing operation, leaving about 0.002 in. should first be adopted, then the gauge allowed to settle before final set up for finish grinding.

This final grinding requires a good deal of patience and the metal should be removed by a true grinding wheel by small cuts of not more than 0.0003 in. until the required size is attained.

Taper Gauges

In making a taper ring and plug gauge, the blanks must be turned with the usual grinding allowances mentioned earlier, and after heat treatment for hardening the plug gauge is produced first, subsequently followed by the ring gauge.

The plug gauge should first have its centres prepared by grinding, and from the turned surface a rough idea of the angle can be obtained and the machine set approximately and a light cut taken over the gauge.



Diagram, showing application of radius or contour gauges

The required angle can be checked by the aid of a sine bar and from the preliminary check of the first cut, the machine can be adjusted.

The correct angle having now been approved, the ends of the gauge can be faced, and by a series of passes. The diameter at the large end can be obtained and the gauge faced to length, care being taken of surface finish.

The ring gauge should be set on the faceplate of the grinding machine after surface grinding the face at the small diameter, and it should be rested on parallel strips. Under no consideration should it be gripped in a chuck, as distortion should not be encouraged.

The same angular setting which produced the plug gauge will be required and by small cuts and repeated passes the size can be obtained by using the plug-gauge until the large end of the taper is just below the surface of the gauge and then this surplus can be removed by face grinding until flush.

Any surplus metal on the face of the small end can be removed when the gauge is released and placed on a surface grinder; it can then be ground to the required length.

Radius and Contour Gauges

Radius gauges can be made by boring on a jig borer the holes of the respective diameter and then machining and filing, or surface grinding tangential to this radius for an external radius, and for an internal radius gauge; this can be bedded to the gauge produced on the jig borer.

A contour gauge needs to be considered in design in order that the gauge will signify where to remove metal from the component being gauged.

As a reference, the gauge can be made to envelop the whole contour, but from the production angle this does not serve any good purpose, and it frequently happens that the gauge has to be designed in a series, for a gauge is not much use if the component piece has to be right before the gauge can be applied.

In the manufacture of such gauges, the sheet steel must be squared on all edges, and this is important, as in the course of the component manufacture, it may be found necessary to use any or all of these edges to locate the gauge.

The contour of the required gauge is marked out on the surface of the gauge steel and sawn out within the line to the required shape and then filed to split the line.

The mating part is similarly produced and each half is then bedded together and to each other.

It is usual to make this type of gauge as male and female, but if by reason only one half is required, then this will be approved to an independent marked layout on another piece of material sheet.

Projection

If the contour or profile gauge is of such size as to come within the range of an optical projector, then full advantage should be made of this device.

Perhaps the best known method to the engineering toolmaker is the comparative method, and a projector offers great scope to this method by comparing the produced contour with a lined contour of many magnifications.

Light Box

A useful piece of kit is a light box, which consists of a shallow wooden or sheet metal box, fitted with a face of opal or ground glass which is secured to the front, the reflection being obtained by the use of one or more electric light bulbs, the inside of the box being painted white.

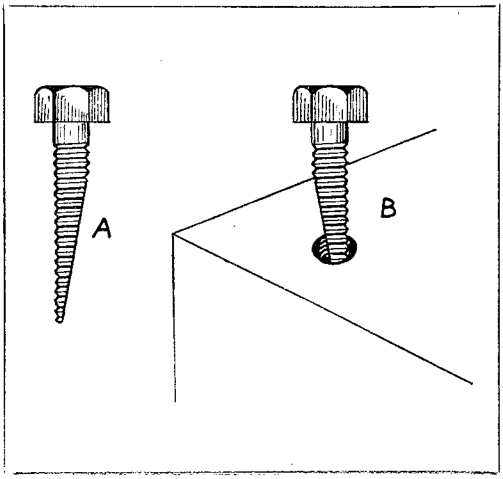
With the aid of this light box, profiles can be examined and the bedding of male and female profiles can be accomplished.

Having thus discussed several aspects of gauge technique, it is hoped that sufficient background has been afforded to give rise to the principles of gauge making hereby explained, and that in following these principles, developments will be forthcoming to study and reflect in good gauges, which will ultimately raise the standard and efficiency of the product.

Cleaning out Threaded Holes

IT is often found in overhauling old machine parts which have been standing neglected for a long time that the threaded holes may have become clogged with dirt, which may be made up of rust and a quantity of loose substance. If it is simply rust, the holes may be re-tapped, using oil which will restore the thread again. If, however, there appears to be a quantity of scale, this can be removed by the following method.

Obtain a bolt of correct size, cut it to shape with hacksaw and file, as indicated at *A* in the accompanying illustration. The shaped bolt is now threaded into the holes, as indicated at *B*.



If the threaded hole goes completely through the work, the scale will, of course, drop clear. In the case of blind holes, the shaped bolt allows the scale to creep clear round the threads. When all loose substance is removed, the tap and oil should be used to restore the thread.—W. J. SAUNDERS.

Queries and Replies

Enquiries from readers, either on technical matters directly connected with model engineering, or referring to supplies or trade services, are dealt with in this department. Each letter must be accompanied by a stamped, addressed envelope, and addressed: "Queries Dept.," THE MODEL ENGINEER, 23, Great Queen Street, London, W.C.2.

Queries of a practical character, within the scope of this journal, and capable of being dealt with in a brief reply, will be answered free of charge.

More involved technical queries, requiring special investigation or research, will be dealt with according to their general interest to readers, possibly by a short explanatory article in an early issue. In some cases, the letters may be published, inviting the assistance of other readers.

Where the technical information required involves the services of an outside specialist or consultant, a fee may be charged depending upon the time and trouble involved. The amount estimated will be quoted before dealing with the query.

Only one general subject can be dealt with in a single query; but subdivision of its details into not more than five separate questions is permissible. In no case can purely hypothetical queries, such as examination questions, be considered as within the scope of this service.

No. 9782.—Making Piston Rings
W.B. (**Morpeth**)

Q.—I am busy making some piston rings for my motor-cycle engine, and as the cylinder has been lapped several times, the commercial ring is found to be too short. I have six rings nicely turned to size and have cut one through with the hacksaw, but found it opened only about $\frac{1}{16}$ in. Can you tell me how to open them to about $\frac{3}{8}$ in. in the same way as the commercial rings?

R.—The conventional method of making piston rings is to turn them larger than the diameter of the cylinder they have to fit by an amount sufficient to give the desired degree of spring. A gap is then cut out of the ring sufficient to enable it to be compressed down to the cylinder size, and the ring is clamped in a jig in a state of compression, and ground or otherwise machined to make it truly circular.

There is, however, a more modern method of making piston rings, in which the ring is made to an exact size and slit with as narrow a saw as possible, after which it is hammered on the inside to expand it and give it the necessary elasticity. This, however, calls for a special process in order to ensure that all parts of the ring spring uniformly, though we have reason to believe that it results in a far more satisfactory ring if properly carried out.

No. 9774.—Drills for Glass and China
W.H.D. (**Leeds**)

Q.—Will you kindly advise me as to what drill I need to drill glass and china.

R.—It is possible to drill glass or china with a simple spearpoint drill made from silver-steel, flattened at the end and ground to an inclined angle of approximately 120 deg. This is hardened out at the extreme tip in water with a trace of oil floating on the top, so as to obtain the maximum hardness, and is used in an Archimedean or hand-drill with light pressure and lubricated with turpentine.

Another method of drilling glass and china, particularly where large holes are required, is to use a piece of copper tube of the required size, charged with carborundum powder and water, which may be retained in the required position by building up a wall of putty around the position of the hole. This tool is preferably used in a drilling machine or lathe to avoid the possibility of wandering from its proper location.

No. 9777.—Electric Clock Contacts
D.B.G. (**Sheffield**)

Q.—I have recently constructed an electric clock from your excellent little book by R. Barnard Way, but have a query which I am unable to solve myself, and shall be obliged if you will assist me. The clock mechanism is working perfectly from the mains and keeping excellent time, but I find a certain amount of arcing at the points, each time contact is made, and, after three weeks, enough carbon has been formed to break contact and stop the clock. After cleaning, the clock works well once more, but arcing continues and I feel sure the same will occur again.

I have used hard white brass for the contact screw (the only type of screw I could obtain) working on to a contact from an old electric bell. I have tried a .004 mfd. condenser across the points, but find no appreciable difference.

R.—It is probable that the difficulty with the contacts in your electric clock is due to the use of unsuitable material. It is necessary to use a refractory metal for the contact points, the most suitable material being platinum or a platinum alloy, but as this is very expensive, silver or gold-silver alloy is often used in instrument contacts and serves fairly well. For extreme durability, tungsten-tipped contacts are generally used, but these are not quite so suitable when very small currents are dealt with, because of the possibility of a surface film forming between the points, and the current flowing is insufficient to burn this away.

The use of a condenser across the points will certainly help to absorb the self-induced current, but a condenser of 0.004 mfd., as suggested, will be much too small for this particular purpose, and we suggest using a condenser of not less than 1 mfd., and of a sufficiently high voltage rating to withstand continuous use on the mains voltage.

PRACTICAL LETTERS

Feed Pump Design

DEAR SIR,—In his letter published in your issue of November 17th, Dr. Fletcher states that "normal temperature means zero on the absolute scale i.e. :—273 deg. F." This statement contains two errors.

"Normal temperature" used in gas calculations is usually reckoned as 0 deg. C., and it is only at 0 deg. C. and 760 mm. mercury pressure that the molecular weight in grammes of any gas occupies 22.4 litres—the premise used in Dr. Fletcher's calculation.

The second error concerns that interesting quantity, the absolute zero itself. It can be shown by experiment that if the pressure is kept constant, the volume of any gas decreases by 1/273rd of its volume at 0 deg. C. for every deg. Centigrade which it is cooled. Theoretically, therefore, at —273 deg. C. the gas will have no volume at all. It is manifestly impossible to imagine anything with *less* than no volume, and so the early physicists decided that —273 deg. C. (not Fahrenheit as stated by Dr. Fletcher) must be the absolute zero below which it is impossible to go.

Modern science has shown that the behaviour of gases at these very low temperatures is not the same as at everyday temperatures, and the old idea of the absolute zero is not absolutely true. Nevertheless, no-one has yet succeeded in cooling any substance below —273 deg. C. though some near approaches have been made.

By chance, the errors mentioned above did not affect Dr. Fletcher's original calculation, but perhaps I may be allowed to give in detail a method for calculating pump capacity applicable to all conditions.

Let the boiler pressure be x lb. per sq. in., the working temperature (*at the cylinders*, including superheat) be y deg. C., and the total volume of the cylinders be z cu. cm. (If the cylinders are double-acting this volume must be doubled.)

It is first necessary to convert the temperature from degrees Centigrade to degrees absolute by adding 273, and the pressure to mm. of mercury by multiplying by 51.7

Thus at $51.7\,x$ mm. mercury and $(y + 273)$ deg. *A*, the volume of steam required per revolution is z cu. cm.

This volume at N.T.P. is

$$z \times \frac{51.7\,x}{760} \times \frac{273}{(y + 273)} \text{ cu. cm.}$$

Now 18 gm. (= 18 cu. cm.) of water give 22.4 litres of steam at N.T.P.

Therefore by proportion the volume of water needed to give the required volume of steam per revolution is :—

$$z \times \frac{51.7\,x}{760} \times \frac{273}{(y + 273)} \times \frac{18}{22{,}400} \text{ cu. cm.}$$

This formula gives the *maximum* output demanded of a direct-coupled pump with the engine at full throttle. If any form of throttling regulator is fitted, the boiler water-level must also be regulated by means of a bypass, because the steam is then reaching the cylinders at a lower pressure than that used in the calculation, and less water will be used.

Yours faithfully,

Bristol. E. J. WINTER, M.C., M.Sc.

Flash Steam Development

DEAR SIR,—In your issue of February 23rd, on page 242, your contributor, Mr. Edgar T. Westbury, deplores, in his own words, "the decline of practical interest in flash steam development."

I share his regret and, in this respect, venture to recall the large measure of commercial success attained more than 50 years ago with full-size vehicles driven by flash steam.

From about the year 1893, self-contained tram cars, propelled by flash steam, designed and constructed by Monsieur Serpollet, were running, and continued to run for many years, in large numbers over the extensive Paris tramway system. Coke was the fuel, and the essential feature of the steam generator was that it was built up of a number of very heavy elements, slightly eliptical in section and with, in the interior, narrow steam space corresponding to the outward form.

In my youth, I rode many times on these vehicles.

Subsequently, with the coming of the automobile, Monsieur Serpollet developed his ideas, and about the year 1900 he was constructing successfully road vehicles mounted on pneumatic tyres, propelled by flash steam, and otherwise conforming to the then most advanced type of automobiles.

I possessed, in the year 1903, a two-seater car, which was the peak of Monsieur Serpollet's development of flash steam propulsion in light road vehicles. The steam generator in this car was of much lighter construction than that employed on the tramways, being built up of circular steel tubing of a heavy gauge, and with limited steam space ; it was fired with kerosene, by a very efficient blow-flame burner.

The motor differed radically from the conventional steam engine in that it had certain features common with the contemporary car internal combustion engines, namely, poppet-valves, single-acting piston, and either two or four cylinders. Water was injected by hand pump, the necessary steam pressure quickly generated, shown by a gauge on the steering column, and the car moved off at once ; the water feed was then automatic by means of an injector with an adjustable delivery. There was no gearbox or clutch, the drive being direct.

I drove this car on one occasion, without breakdown or minor trouble, from London to Glasgow, a performance uncommon to the then internal combustion engine-driven motor cars. My Serpollet took part in a hill-climbing competition in Glasgow. Its brilliant performance, by reason of the rapid and silent ascent, in comparison with the laborious toiling of the then petrol-driven vehicle, would have secured it first place had not the failure of one of the boiler tubes when approaching the summit, brought the ascent to an end.

A car specially constructed by Monsieur Serpollet was the first road vehicle to reach the speed of 60 miles an hour by an official performance on the Promenade des Anglais at Nice in 1899, a performance which was thought by devoted partisans of the petrol engine (among those, including myself) could not be reached by the internal combustion engine for many years.

Further flash steam development was terminated about 1905 by the untimely death of the brilliant and charming Monsieur Serpollet.

In the interval, metallurgy has made immense advances, rendering possible the high steam temperatures of today.

I would like to believe that these two factors alone, in the fascinating problem of flash steam, might fire the imagination of some talented young moderns to essay both models and full-scale, in this little-explored field.

Yours faithfully,

Solihull. ROBERT BIRD.

Air Plant

DEAR SIR,—I am interested in the query in February 16th issue relative to hot air engines, but disappointed in your reply which gives the inquirer no idea of the great development of this system by the Escher-Lyss Co., of Zurich, Switzerland, who actually had in operation five years ago a 6,500-h.p. hot air plant, with a 15,000-h.p. one projected. One must, of course, realise that these are not self-contained hot air engines, such as we have known for 50 years past and to which you refer, but that the modern system is to use air instead of water *in a closed circuit* and this air is so treated as to vary between the wide limits of a few degrees up to 1,200 deg. or so, with corresponding pressure. This pressure is then utilised in a turbine.

The main justification for air-power is, according to the Escher-Wyss Co. :—

(*a*) Temperatures and pressures independent of atmosphere.

(*b*) Non-corrosive flow of air through turbine (part of closed system).

(*c*) Low-grade heater fuel.

Incidentally, of the 6,500 h.p. in an air plant, 60 per cent. is used to drive the compressor and 40 per cent. is generator output, justifying the remarks of one of your contributors a few weeks ago as to gas-turbines and indeed any system in which a compressor is used.

An air plant being a generating station one, is, of course, very large and spacious, so only experiment can determine how small this system could be made or, indeed, whether a model system could be made at all, but the fact that over 6,000 h.p. can be produced from air is sufficiently remarkable.

Photographs of this plant can be seen in *Engineering* of January, 1946, and as I am in no way connected with the Escher-Wyss Co., I merely bring this information forward to show what is being done in this direction.

Yours faithfully,

London, S.W.7. K. DICKSON.

Hot Air Engines

DEAR SIR,—If your Rugby correspondent who is interested in hot air engines will get in touch with me I will gladly give him all the information he requires to build one of these fascinating models. I have built several of this type of engine.

I can never understand why the hot air engine is not more popular. It is easy to construct, clean and silent when running, and will run for hours on end with no attention beyond a spot of oil occasionally. Of course, if it is power one requires, that is a different matter.

Yours faithfully,

Rugby. F. L. SOUTHAM.

[*We shall be pleased to forward any correspondence addressed to Mr. Southam, c/o this office.*—EDITOR, THE MODEL ENGINEER.]

Modifications to a Sight-feed Lubricator

DEAR SIR,—I was very interested to note that the S.M.E.E. are fitting to their locomotives the sight-feed lubricator described by myself in the issue for November 27th, 1947.

This lubricator has been fitted to my 1-in. scale tank locomotive, which, after a six-hour bench test, has had its first track test recently.

I found traces of oil in the boiler steam turret, presumably caused when a drop in boiler pressure allowed the contents of the oil reservoir to expand slightly ; and if the lubricator had recently been filled and had no condensate at the bottom, some oil found its way through the small pipe from the oil reservoir to the boiler turret.

This was cured by fitting a balancing chamber, consisting of a 2-in. length of $\frac{3}{8}$-in. tube with brass blanks silver-soldered into the ends, and fitted vertically into a 3/32-in. pipe from boiler turret to oil reservoir. $1\frac{1}{4}$ in. was cut out from the existing pipe, the ends of which were silver-soldered into the ends of the balancing chamber. Alternatively, a much longer 3/32-in. pipe could be used.

It was found that when refilling the lubricator, should the regulating valve on the sight glass not be closed, water from the glass would run down into the lubricator reservoir, necessitating cleaning and refilling the sight feed fitting before running could be resumed.

A check-valve has now been fitted between the sight feed fitting and the oil reservoir. This has no effect on the working of the lubricator and only comes into effect when pressure is released from the oil reservoir.

Possibly due to longer oil pipes on the 1-in. scale job, the drops of oil passed up through the sight glass in large blobs (heavy superheater oil) occasionally touching the sides of the glass, when the "sight feed" function no longer operated as the glass became full of oil.

To overcome this, a pinch of salt was added to the water in the glass, increasing its gravity. The oil now behaves itself, the size of oil drops being in relation to the amount of salt added to the water in the glass.

There is no evidence that any of the salt is absorbed by the oil, as the lubricator has worked perfectly for some hours since the salt was added.

Yours faithfully,

Perivale, Middx. F. COTTAM.